Validation Report

Kansas, SPS-2
Task Order 18, CLIN 2
April 17 to 18, 2007

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1 Executive Summary

A visit was made to the Kansas 0200 site on April 17 to 18, 2007 for the purposes of conducting a validation of the WIM system located on I-70 at 1 mile west of the Chapman interchange. The SPS-2 is located in the righthand, westbound lane of a four-lane divided facility. The LTPP lane is the only lane that is instrumented at this site. The validation procedures were in accordance with LTPP's SPS WIM Data Collection Guide dated August 21, 2001.

This site was installed as part of a relocation of the abandoned site located approximately 400 feet west of this site. This is the second validation visit to this location, the first occurring October 31 and November 1, 2006. The site was installed as part of Phase 2 of the Pooled Fund Study on June 6 to 8, 2006 by IRD.

This site demonstrates the ability to produce research quality loading data under the observed conditions. The classification data is also of research quality.

The site is instrumented with bending plate WIM Sensors and iSINC electronics. It is installed in portland cement concrete, 400 feet long.

The validation used the following trucks:

1) 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 78,590 lbs., the "golden" truck.
2) 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and a tapered leaf suspension loaded to 66,510 lbs., the "partial" truck.

The validation speeds ranged from 54 to 70 miles per hour. The pavement temperatures ranged from 52 to 94 degrees Fahrenheit. The desired speed range was achieved during this validation. The desired 30 degree Fahrenheit temperature range was achieved.

Table 1-1 Post-Validation results – 200200 – 18-Apr-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.3 ± 10.7%	Pass
Tandem axles	±15 percent	0.6 ± 9.2%	Pass
GVW	±10 percent	0.5 ± 6.3%	Pass
Speed	±1 mph [2 km/hr]	0.1 ± 0.8 mph	Pass
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

The pavement condition appeared satisfactory for conducting a performance evaluation. There were no distresses observed that would influence truck motions significantly. A visual survey determined that there is no discernable bouncing or avoidance by trucks in the sensor area.

Profile data for this site was collected by the Regional Support Contract on June 5, 2006. As we have noted above, installation activities began on June 6, 2006, therefore the profile data collected was not utilized in the preparation of this report, as the scales were not installed at the time of its collection.

If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 1-2 Results Based on ASTM E-1318-02 Test Procedures

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

This site needs five years of data to meet the goal of five years of research quality data.

2 Corrective Actions Recommended

The cable conduit from the leading WIM sensor and loop sensor is broken at the point where the shoulder meets the grade as shown in Figure 2-1. The conduit needs to be replaced to prevent damage to the sensor lead-ins.

Figure 2-1 - Broken Conduit at 200200 – 17-Apr-2007

The trench for the conduit leading from the roadside pull box to the cabinet has collapsed. As shown in Figure 2-2. The trench needs to be filled and compacted.

Figure 2-2 - Collapsed Conduit Trench - 200200 - 17-Apr-2007

No other corrective actions are required at this time.

3 Post Calibration Analysis

This final analysis is based on test runs conducted April 18, 2007 during the morning and afternoon hours at test site 200200 on I-70. This SPS-2 site is at milepost 287.5 on the westbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for the calibration and for the subsequent validation included:

1. 5-axle tractor-trailer with a tractor having an air suspension and trailer with a standard rear tandem and air suspension loaded to 78,590 lbs., the "golden" truck.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and a tapered leaf suspension loaded to 66,510 lbs., the partial truck.

Each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 54 to 70 miles per hour. The desired speed range was achieved during this validation. Pavement surface temperatures were recorded during the test runs ranging from about 52 to 94 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 3-1.

As shown in Table 3-1, this site meets all of the performance criteria for research quality data.

Table 3-1 Post-Validation Results – 200200 – 18-Apr-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-0.3 ± 10.7%	Pass
Tandem axles	±15 percent	0.6 ± 9.2%	Pass
GVW	±10 percent	0.5 ± 6.3%	Pass
Speed	±1 mph [2 km/hr]	0.1 ± 0.8 mph	Pass
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

The sunny weather conditions during the entire testing period resulted in a wide range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and three temperature groups. The distribution of runs by speed and temperature is illustrated in Figure 3-1. The figure indicates that the desired distribution of speed and temperature combinations was achieved for this set of validation runs.

The three speed groups were divided as follows: Low speed – 54 to 59 mph, Medium speed – 60 to 67 mph and High speed – 68+ mph. The three temperature groups were created by splitting the runs between those at 52 to 64 degrees Fahrenheit for Low

temperature, 65 to 79 degrees Fahrenheit for Medium temperature and 80 to 94 degrees Fahrenheit for High temperature.

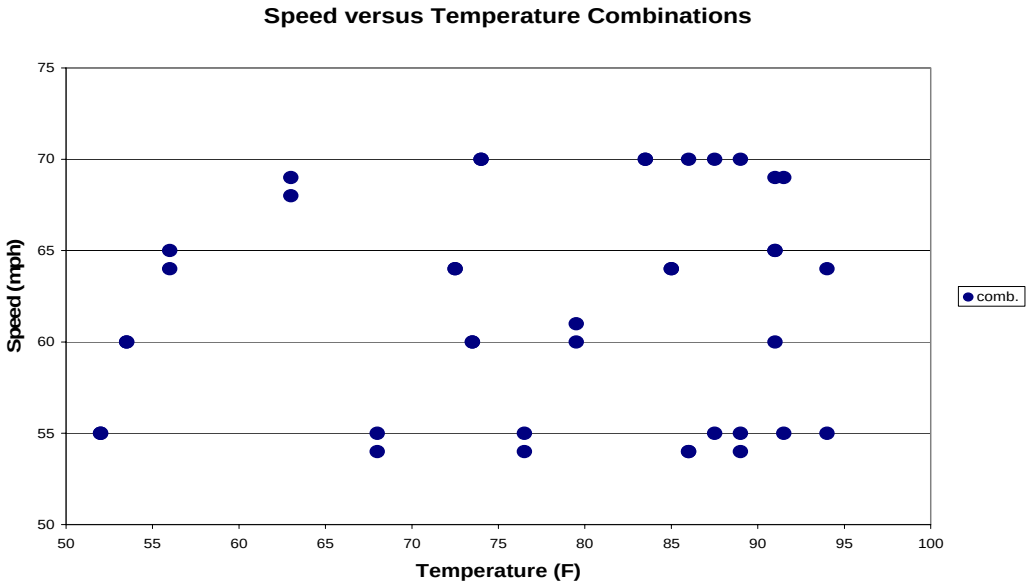


Figure 3-1 Post-Validation Speed-Temperature Distribution – 200200 – 18-Apr-2007

A series of graphs was developed to investigate visually any sign of a relationship between speed or temperature and the scale performance. Figure 3-2 shows the GVW Percent Error vs. Speed graph for the population as a whole.

From the figure, it appears that the equipment estimates GVW reasonably at lower speeds and the increasingly overestimates GVW as speed increases. Variability in error appears to be consistent over the entire speed range.

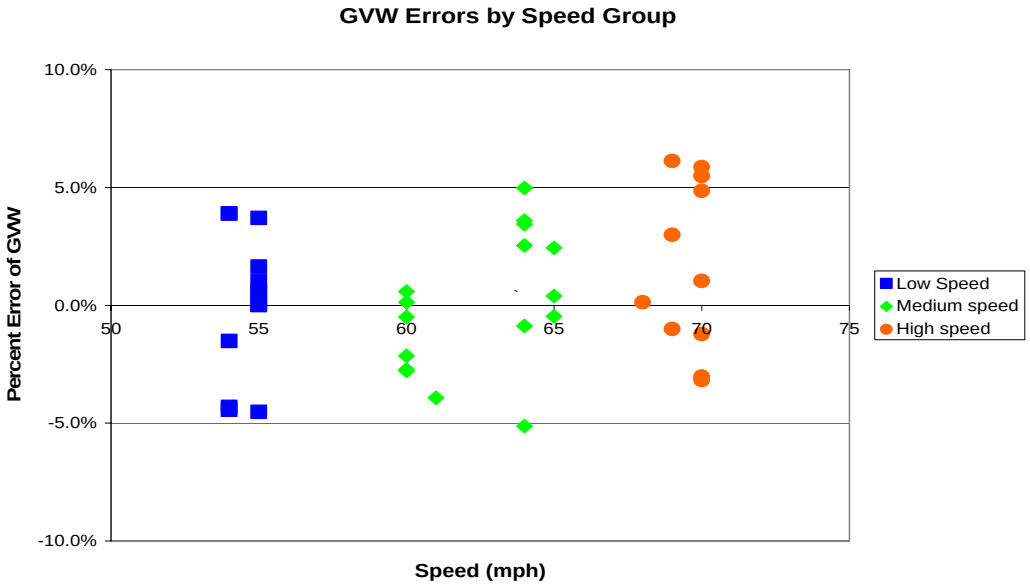


Figure 3-2 Post-validation GVW Percent Error vs. Speed – 200200 – 18-Apr-2007

Figure 3-3 shows the shows a lack of a relationship between temperature and GVW percentage error.

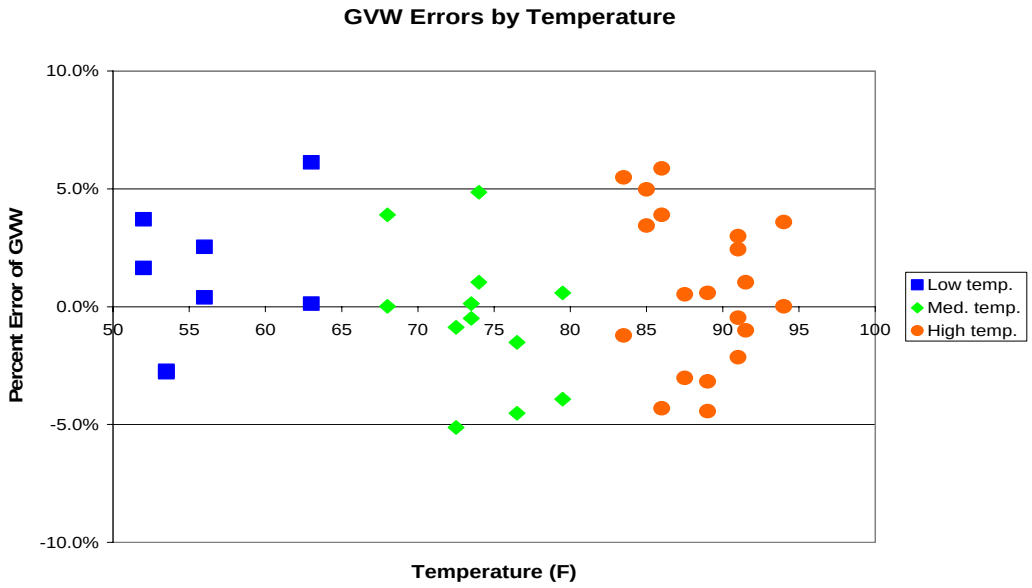


Figure 3-3 Post-Validation GVW Percent Error vs. Temperature – 200200 – 18-Apr-2007

Figure 3-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed. Variability in spacing error is greater at the lower speeds. The speeds at which this variability exists are below the 15th percentile speed for the site. The errors are expected to have minimal impact on classification distributions.

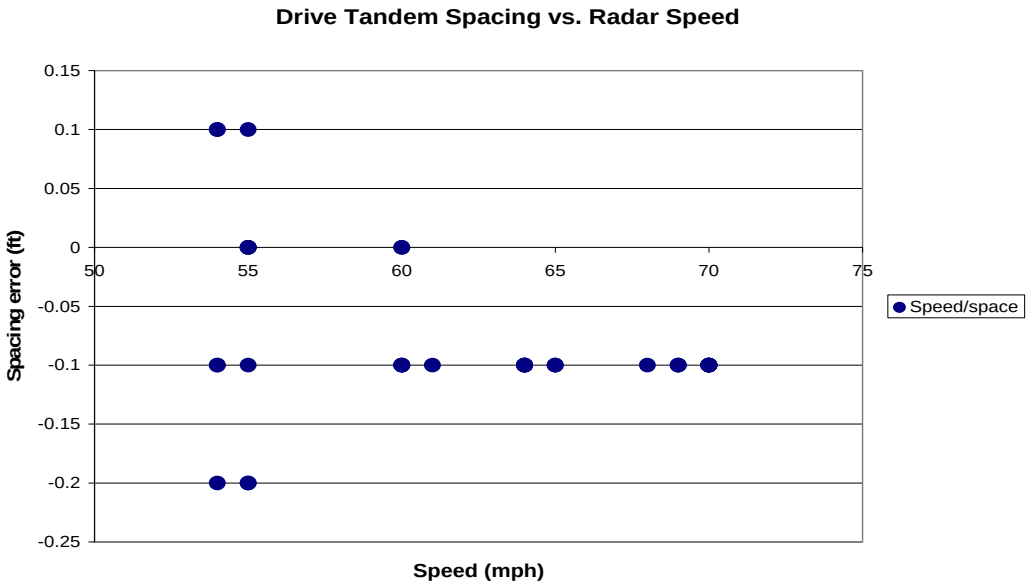


Figure 3-4 Post-Validation Spacing vs. Speed – 200200 – 18-Apr-2007

3.1 Temperature-based Analysis

The three temperature groups were created by splitting the runs between those at 52 to 64 degrees Fahrenheit for Low temperature, 65 to 79 degrees Fahrenheit for Medium temperature and 80 to 94 degrees Fahrenheit for High temperature.

Table 3-2 Post-Validation Results by Temperature Bin – 200200 – 18-Apr-2007

Element	95% Limit	Low Temperature 52 to 64 °F	Medium Temperature 65 to 79 °F	High Temperature 80 to 94 °F
Steering axles	±20 %	-1.2 ± 10%	-2 ± 11.4%	1.1 ± 11.7%
Tandem axles	±15 %	1.4 ± 8.9%	-0.1 ± 9.6%	0.7 ± 9.7%
GVW	±10 %	1.1 ± 7.2%	-0.5 ± 6.7%	0.8 ± 6.8%
Speed	±1 mph	-0.1 ± 0.8 mph	0.2 ± 0.9 mph	0.1 ± 0.9 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	-0.1 ± 0.2 ft	-0.1 ± 0.1 ft

From Table 3-2, it appears that the equipment estimates all weights with reasonable accuracy at all temperatures. Individually, variability in error for each weight group appears to be consistent throughout the entire temperature range.

Figure 3-5 is the distribution of GVW Errors versus Temperature by Truck graph. From the figure, it appears that GVW mean error is not particularly affected by temperature. Variability appears to be slightly less at the lower temperatures, although this may be driven by the lower number of samples at those temperatures.

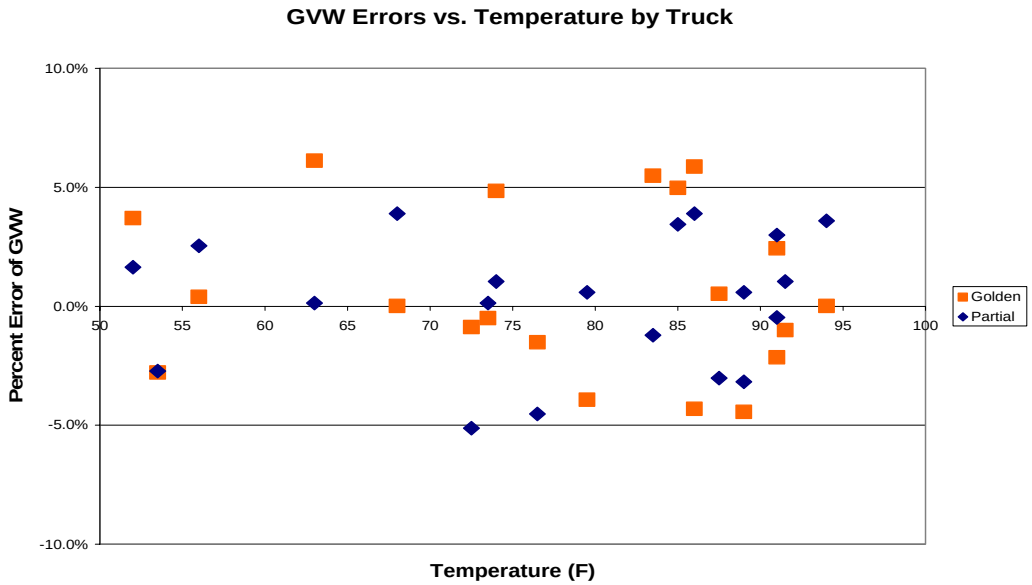


Figure 3-5 Post-Validation GVW Percent Error vs. Temperature by Truck – 200200 – 18-Apr-2007

Figure 3-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles.

From the figure, it can be seen that the equipment estimates steering axle weights with reasonable accuracy throughout the temperature range. Variability in steering axle error appears to be lesser at the lower temperatures.

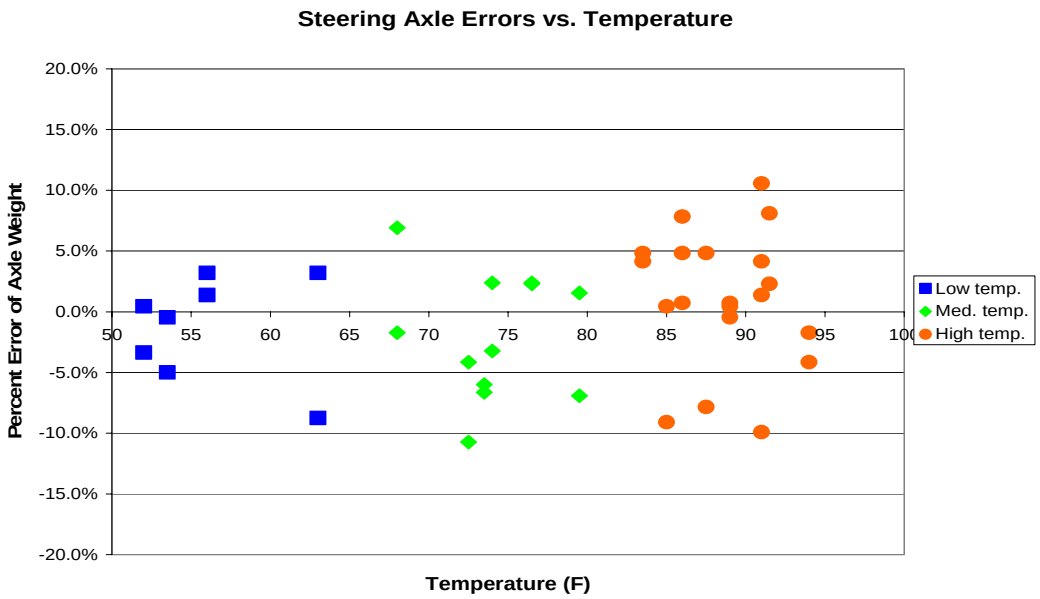


Figure 3-6 Post-Validation Steering Axle Error vs. Temperature by Group – 200200 – 18-Apr-2007

3.2 Speed-based Analysis

The three speed groups were divided using 54 to 59 mph for Low speed, 60 to 67 mph for Medium speed and 68+ mph for High speed.

Table 3-3 Post-Validation Results by Speed Bin – 200200 – 18-Apr-2007

Element	95% Limit	Low Speed 54 to 59 mph	Medium Speed 60 to 67 mph	High Speed 68+ mph
Steering axles	±20 %	1.7 ± 7.2%	-2.8 ± 12.2%	1.0 ± 12.2%
Tandem axles	±15 %	-0.3 ± 8.2%	0.5 ± 9.8%	1.7 ± 10.3%
GVW	±10 %	0.0 ± 6.6%	0.0 ± 6.2%	1.6 ± 8.0%
Speed	±1 mph	0.2 ± 0.8 mph	0.0 ± 0.8 mph	0.1 ± 1.2 mph
Axle spacing	± 0.5 ft	0.0 ± 0.2 ft	-0.1 ± 0.1 ft	-0.1 ± 0.0 ft

From Table 3-3, it can be seen that the equipment tends to estimate all weights with reasonable accuracy at all speeds. Variability in error for all weights generally increases as speed increases.

Figure 3-7 illustrates the ability of the equipment to estimate GVW with reasonable accuracy at the lower speeds, and then appears to have the tendency to increasingly overestimate GVW as speed increases. Both trucks appear to demonstrate the same speed trends. Variability in error appears to be slightly greater at the higher speeds. The overestimation is occurring near the 85th percentile speed.

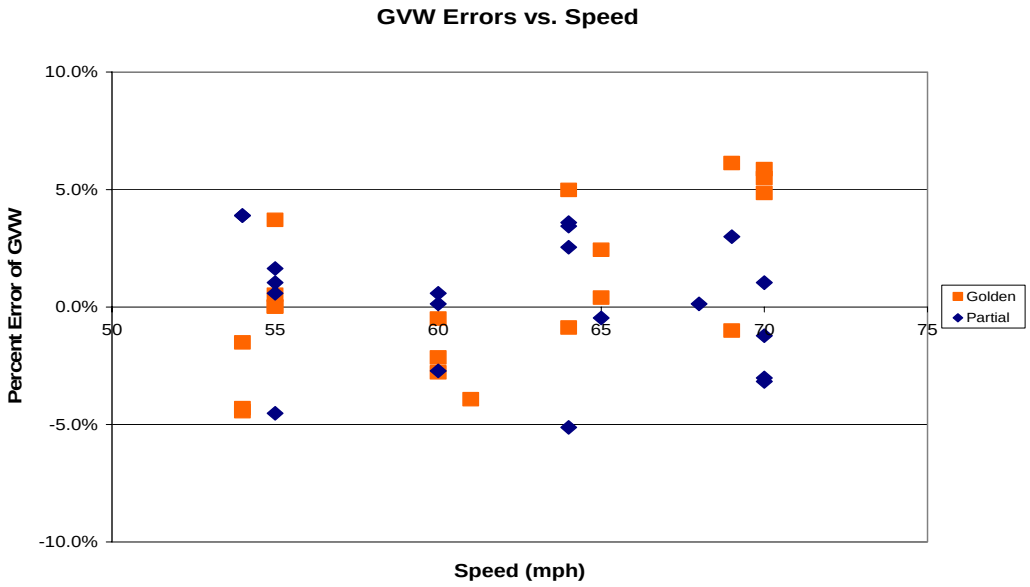


Figure 3-7 Post-Validation GVW Percent Error vs. Speed by Truck – 200200 – 18-Apr-2007

Figure 3-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles.

From the figure, it appears that the WIM equipment overestimates steering axle weights at the lower speeds and underestimates steering axle weights at the medium and higher speeds. The variability of error by truck seems to be greater at the medium and high speeds when compared with the lower speeds.

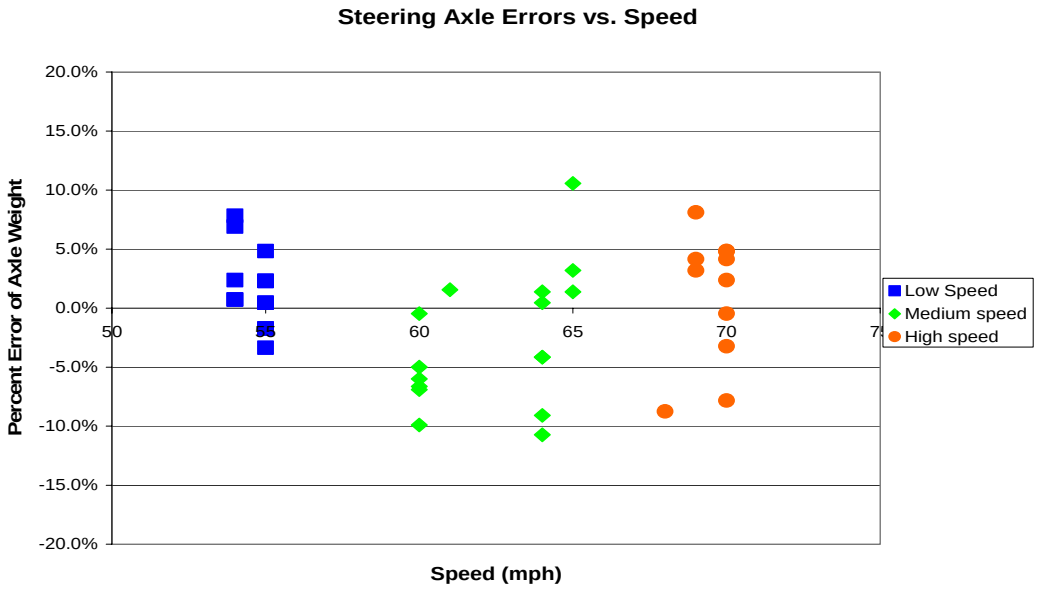


Figure 3-8 Post-Validation Steering Axle Percent Error vs. Speed by Group – 200200 – 18-Apr-2007

3.3 Classification Validation

This LTPP installed site uses the FHWA 13-bin classification scheme and the LTPP classification algorithm. Classification 15 has been added to define unclassified vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 trucks was collected at the site. Video was also taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 3-4 has the classification error rates by class. The overall misclassification rate is 0 percent.

Table 3-4 Truck Misclassification Percentages for 200200 – 18-Apr-2007

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5	0	6	0
7	N/A				
8	0	9	0	10	0
11	0	12	0	13	N/A

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent.

The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 3-5 Truck Classification Mean Differences for 200200 – 18-Apr-2007

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5	0	6	0
7	N/A				
8	0	9	0	10	0
11	0	12	0	13	N/A

These error rates are normalized to represent how many vehicles of the class are expected to be over or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them or one hundred out of one hundred. Numbers 1 or larger indicate at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown are those identified by the equipment but no vehicles of the type were seen by the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer.

3.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 3-6 Results of Validation Using ASTM E-1318-02 Criteria

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	100%	Pass
Axle Groups	± 15%	100%	Pass
GVW	± 10%	100%	Pass

4 Pavement Discussion

The pavement condition did not appear to influence truck movement across the sensors.

4.1 Profile Analysis

Profile data collected after the site installation does not exist. A site visit to collect profile data has not been scheduled yet. An amended report will be submitted when the data is available.

4.2 Distress Survey and Any Applicable Photos

During a visual survey of the pavement no distresses that would influence truck movement across the WIM scales were noted.

4.3 Vehicle-pavement Interaction Discussion

A visual observation of the trucks as they approach, traverse and leave the sensor area did not indicate any visible motion of the trucks that would affect the performance of the WIM scales. Trucks appear to track down the wheel path and daylight cannot be seen between the tires of any of the sensors for the equipment.

5 Equipment Discussion

The traffic monitoring equipment at this location includes bending plate and iSINC. These sensors are installed in a staggered configuration in a portland cement concrete pavement about 400 ft in length.

All equipment and sensors were installed from June 6 to June 8, 2006 as part of the SPS WIM Phase II contract.

5.1 Pre-Evaluation Diagnostics

A complete electronic and electrical check of all system components including in-road sensors, electrical power, and telephone service were performed immediately prior to the evaluation. All sensors and system components were found to be within operating parameters. As with the prior validation, the trailing loop gave low resistive values between the loop wires and the cable shield; however, the loop appears to working properly.

The “ghost” axle problem experienced during the last validation was again noted during this validation. Consultation with the manufacturer’s installation representative resulted in adjusting (raising) the system threshold setting. This adjustment was performed after the first four trucks runs and appeared to eliminate the problem.

A complete visual inspection of all WIM system and support components was also conducted. The cable conduit from the leading sensors has been damaged and needs to be repaired. All other components appeared to be in good physical condition.

5.2 Calibration Process

The equipment required one iteration of the calibration process between the initial 40 runs and the final 40 runs due to failure of steering axle errors to meet the definitions of research quality data.

5.2.1 Calibration Iteration 1

For this equipment, there are 5 speed designated weight compensation factors that are adjusted to directly affect the weight reported by the WIM equipment. To reduce overestimation of weights these factors are reduced by the same percentage of the overestimation. If the weights are underestimated, these factors are increased by the same percentage as the mean error.

For this equipment, the final system compensation factors from the last validation were:

- 55 mph – 3570
- 60 mph – 3680
- 65 mph – 3720
- 70 mph – 3755
- 75 mph – 3700

At some time between the last validation visit and this visit these factors were raised 6%, and resulted in the following preliminary compensation factors for this visit:

- 55 mph – 3784
- 60 mph – 3901
- 65 mph – 3943
- 70 mph – 3980
- 75 mph – 3922

The results of the Pre-Validation from April 17, 2007 are illustrated in Figure 5-1. As shown, the equipment demonstrated a tendency to underestimate GVW at medium and high speeds. Scatter appeared to be greater at the medium and high speeds.

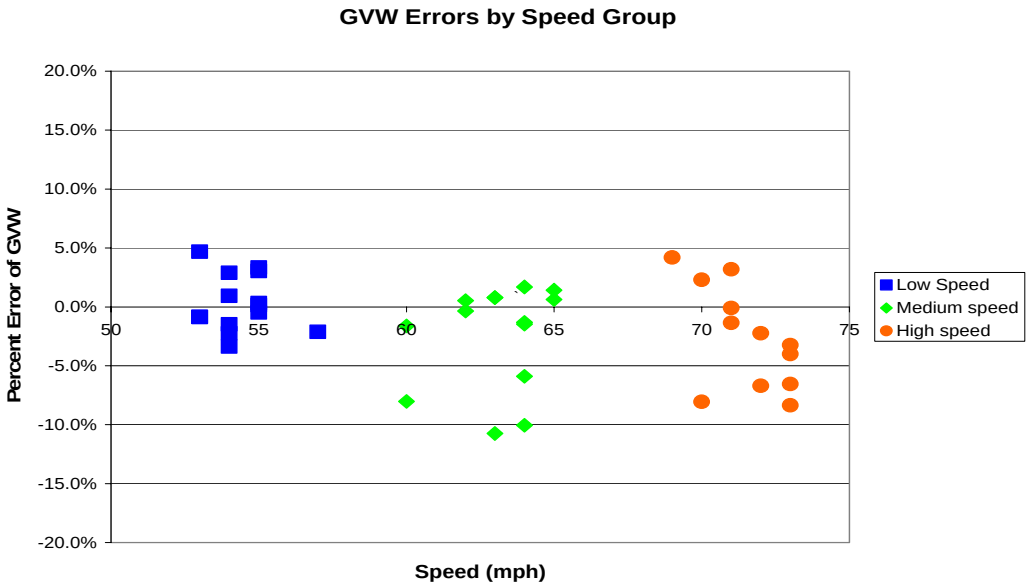


Figure 5-1 – Pre-validation GVW Percent Error vs. Speed – 200200 – 17-Apr-2007

Based on the results from the Pre-Validation of April 17, 2007, which produced an error range of -10.0% to +5.0%, the compensation factors were adjusted as follows:

- 55 mph – not changed at 3784
- 60 mph – increased 2.0% to 3979

- 65 mph – increased 2.0% to 4022
- 70 mph – increased 2.0% to 4060
- 75 mph – increased 5.0% to 4118

Changes were made by the Validation Task Leader. Results of the Calibration verification are shown in Table 5-1 and Figure 5-2.

Table 5-1 Calibration Iteration 1 Results – 200200 – 04-Apr-2007 (9:20:00 AM)

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-2.0 ± 10.2%	Pass
Tandem axles	±15 percent	1.4 ± 8.9%	Pass
GVW	±10 percent	1.0 ± 7.3%	Pass
Speed	±1 mph	-0.1 ± 0.8 mph	Pass
Axle spacing	± 0.5 ft	-0.1 ± 0.1 ft	Pass

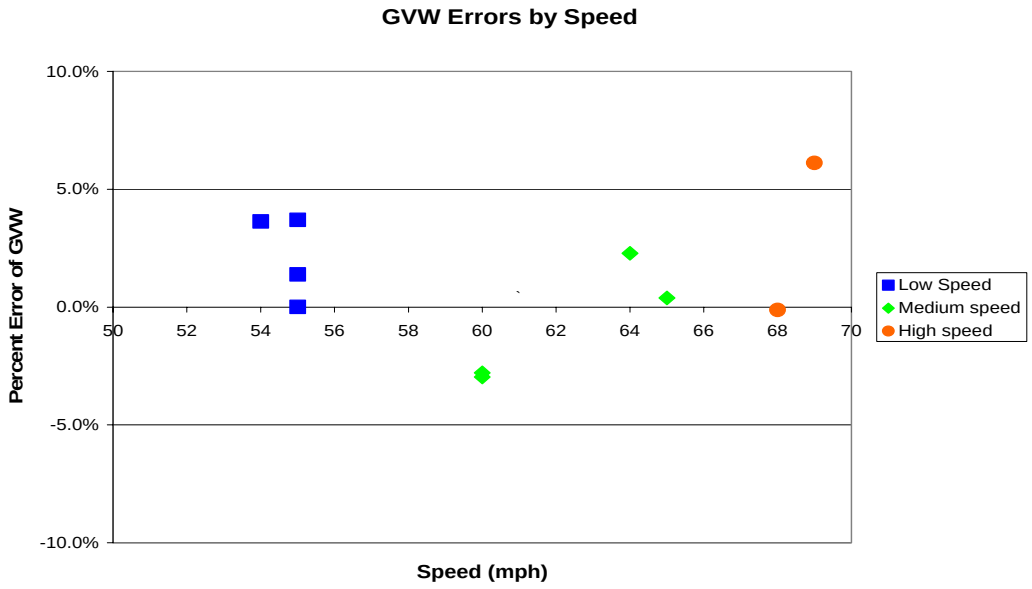


Figure 5-2 Calibration Iteration 1 GVW Percent Error vs. Speed Group – 200200 – 04-Apr-2007 (9:20:00 AM)

After the first calibration, it was determined that the system was estimating all weights reasonably well and so further calibration was not deemed necessary. Thirty additional test runs were conducted to complete the requirement of forty post-validation runs.

5.3 Summary of Traffic Sheet 16s

This site has validation information from previous visits as well as the current one in the tables below. Table 5-2 has the information for the Pavement Performance database table

TRF_CALIBRATION_AVC for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-2 Classification Validation History – 200200 – 18-Apr-2007

Date	Method	Mean Difference				Percent Unclassified
		Class 9	Class 8	Other 1	Other 2	
04/18/07	Manual	0.0	0.0			0.0
04/17/07	Manual	-1.2	0.0			0.0
11/01/06	Manual	1.2	0.0			0.0
10/31/06	Manual	3.0	22.2			0.0

Table 5-3 has the information for the Pavement Performance database table TRF_CALIBRATION_WIM for Sheet 16s submitted prior to this validation as well as the information for the current visit.

Table 5-3 Weight Validation History – 200200 – 18-Apr-2007

Date	Method	Mean Error and (SD)		
		GVW	Single Axles	Tandem Axles
04/18/07	Test Trucks	0.5 (3.1)	-0.3 (5.3)	0.6 (4.6)
04/17/07	Test Trucks	-1.5 (3.9)	-3.0 (8.7)	-1.2 (5.5)
11/01/06	Test Trucks	-1.6 (2.3)	-4.8 (3.8)	-1.1 (2.9)
10/31/06	Test Trucks	-1.2 (3.2)	-3.8 (4.7)	-1.8 (6.7)

5.4 Projected Maintenance/Replacement Requirements

There are no corrective maintenance actions required at this site at this time.

Under a separate LTPP contract, this site is to be visited semi-annually for routine preventive equipment diagnostics and inspection. Annual validations are also anticipated.

6 Pre-Validation Analysis

This pre-validation analysis is based on test runs conducted April 17, 2007 during the morning and afternoon hours at 200200 on 1 mile west of the Chapman interchange. This SPS-2 site is at milepost 287.5 on I-70 in the westbound, righthand of a four-lane divided facility. No auto-calibration was used during test runs. The two trucks used for initial validation included:

1. 5-axle tractor semi-trailer combination with a tractor having an air suspension and trailer with standard rear tandem and an air suspension loaded to 79,370 lbs.
2. 5-axle tractor semi-trailer with a tractor having an air suspension and a trailer with a standard rear tandem and a tapered leaf suspension loaded to 66,770 lbs., the “partial” truck.

For the initial validation each truck made a total of 20 passes over the WIM scale at speeds ranging from approximately 53 to 70 miles per hour. The desired speed range was achieved during this validation. Surface temperatures were recorded during the test runs ranging from about 52 to 72 degrees Fahrenheit. The desired 30 degree Fahrenheit temperature range was not achieved. The computed values of 95% confidence limits of each statistic for the total population are in Table 6-1.

As shown in Table 6-1, the site did not meet the requirements for steering axle or speed accuracies. It was determined that a calibration was necessary to bring the system within tolerances.

Table 6-1 Pre-Validation Results – 200200 – 17-Apr-2007

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	**-3.0 ± 17.5%**	**Fail**
Tandem axles	±15 percent	-1.2 ± 10.9%	Pass
GVW	±10 percent	-1.5 ± 7.9%	Pass
Speed	±1 mph [2 km/hr]	**-0.3 ± 1.1 mph**	**Fail**
Axle spacing	± 0.5 ft [150mm]	-0.1 ± 0.1 ft	Pass

The test runs were conducted primarily during the mid-morning to late afternoon hours. Full cloud cover during the entire test period resulted in a narrow range of pavement temperatures. The runs were also conducted at various speeds to determine the effects of these variables on the performance of the WIM scale. To investigate these effects, the dataset was split into three speed groups and two temperature groups. The distribution of runs within these groupings is illustrated in Figure 6-1. The figure indicates that the desired distribution of speed and temperature combinations was not achieved for this set of validation runs.

The three speed groups were divided into 53 to 59 mph for Low speed, 60 to 67 mph for Medium speed and 68+ mph for High speed. The two temperature groups were created by splitting the runs between those at 52 to 65 degrees Fahrenheit for Low temperature and 66 to 72 degrees Fahrenheit for High temperature.

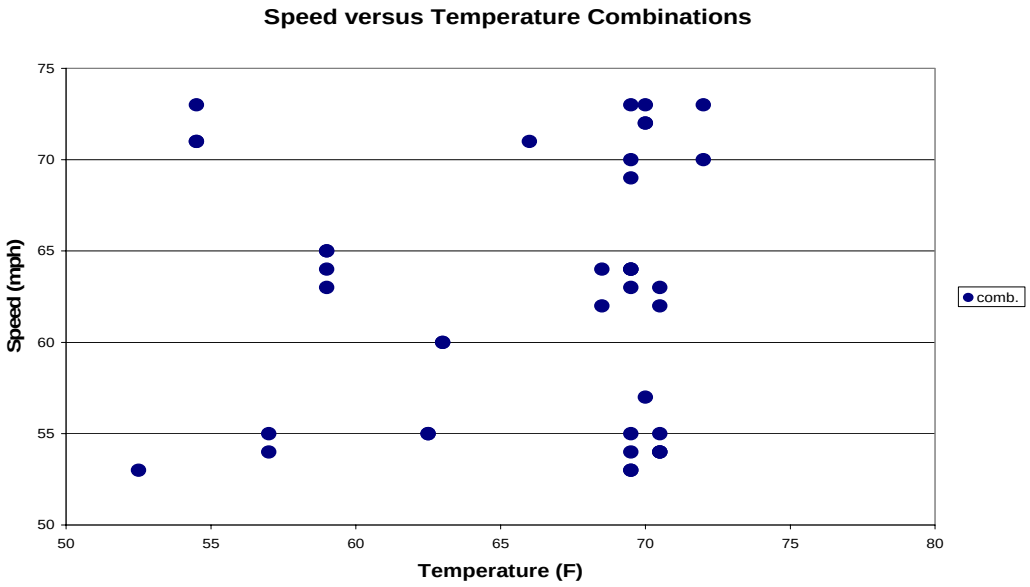


Figure 6-1 Pre-Validation Speed-Temperature Distribution – 200200 – 17-Apr-2007

A series of graphs was developed to investigate visually for any sign of any relationship between speed or temperature and the scale performance.

Figure 6-2 shows the GVW Percent Error vs. Speed graph for the population as a whole. The figure illustrates the tendency for the equipment to overestimate GVW at low speeds and underestimate GVW at medium and high speeds. Variability appears greater at the medium and high speeds.

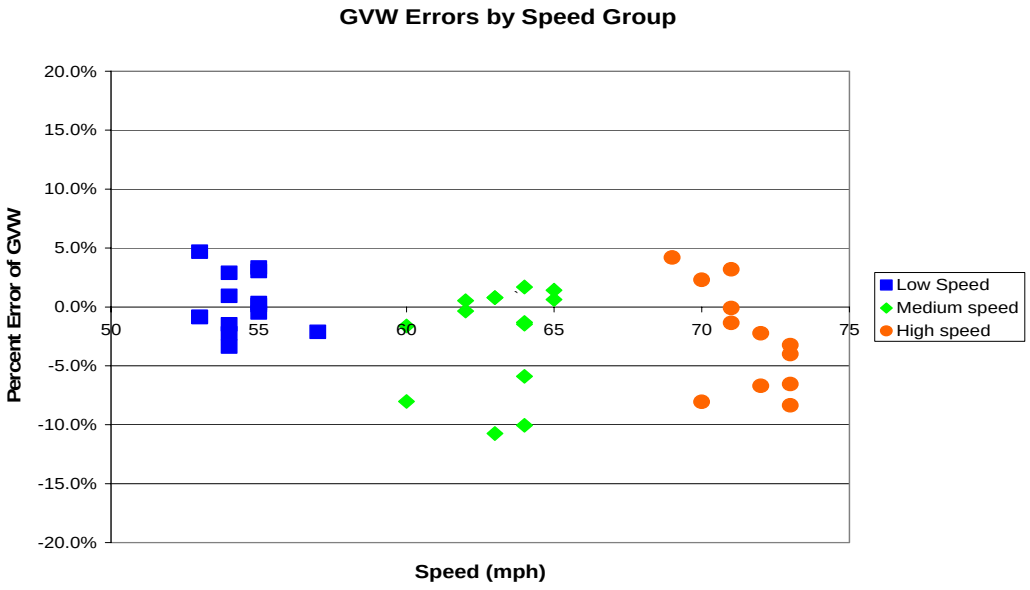


Figure 6-2 Pre-validation GVW Percent Error vs. Speed – 200200 – 17-Apr-2007

Figure 6-3 shows the relationship between temperature and GVW percentage error. From the figure, it appears that the GVW is measured reasonably accurately over the entire temperature range. Variability in error appears slightly greater at the higher end of the temperatures range.

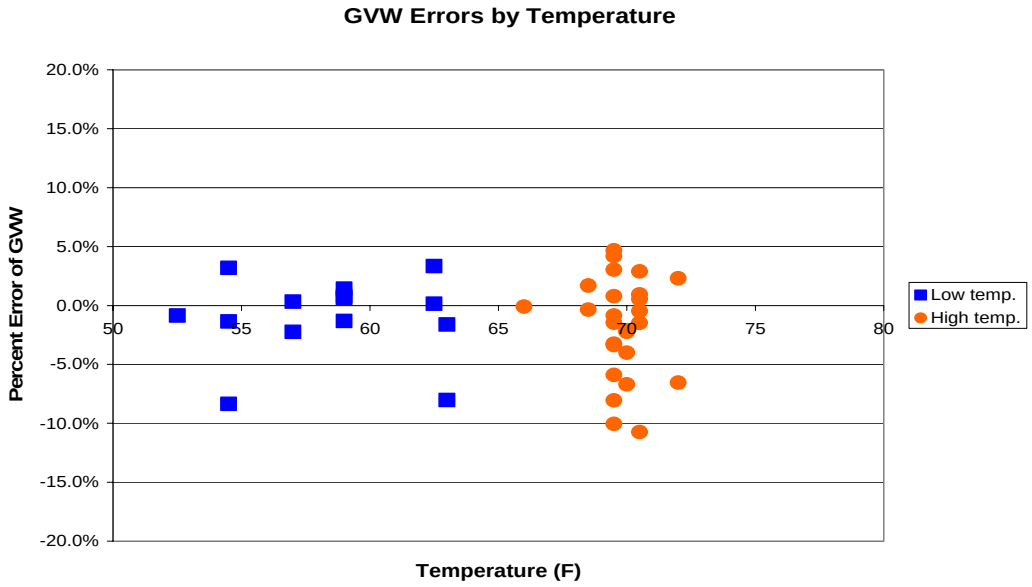


Figure 6-3 Pre-Validation GVW Percent Error vs. Temperature – 200200 – 17-Apr-2007

Figure 6-4 shows the relationship between the drive tandem spacing errors in feet and speeds. This graph is used as a potential indicator of classification errors due to failure to correctly identify spacings on a vehicle. Since the most common reference value is the drive tandem on a Class 9 vehicle, this is the spacing evaluated and plotted for validations. The graph indicates that the errors in tandem spacings for the test trucks were not affected by changes in speed. Variability in spacing error is greater at the lower speeds.

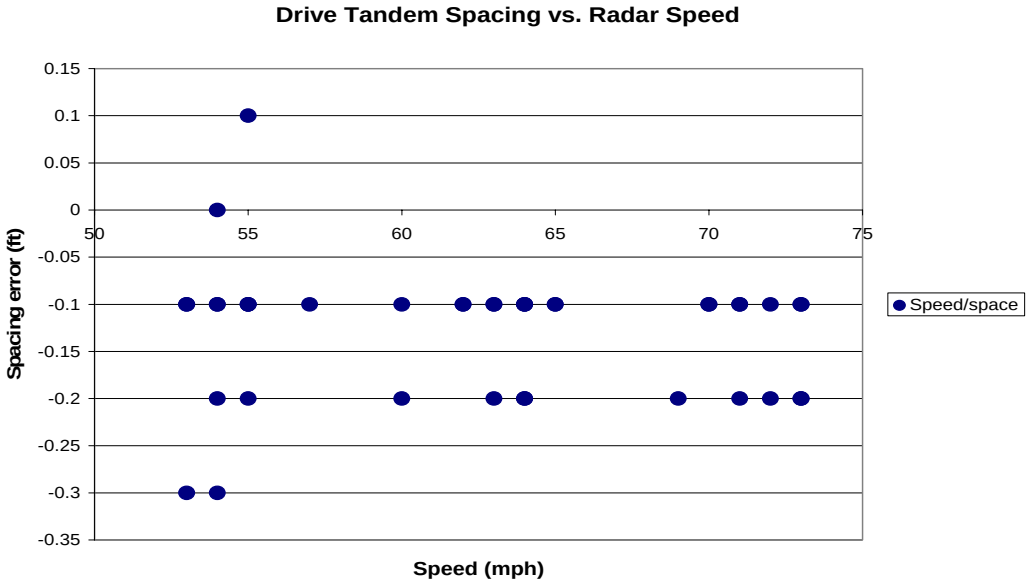


Figure 6-4 Pre-Validation Spacing vs. Speed - 200200 – 17-Apr-2007

6.1 Temperature-based Analysis

The two temperature groups were created by splitting the runs between those at 52 to 65 degrees Fahrenheit for Low temperature and 66 to 72 degrees Fahrenheit for High temperature.

Table 6-2 Pre-Validation Results by Temperature Bin – 200200 – 17-Apr-2007

Element	95% Limit	Low Temperature 52 to 65 °F	High Temperature 66 to 72 °F
Steering axles	±20 %	-1.1 ± 17.9%	-4.1 ± 18.2%
Tandem axles	±15 %	-1.0 ± 8.4%	-1.3 ± 12.3%
GVW	±10 %	-1.0 ± 7.5%	-1.8 ± 8.6%
Speed	±1 mph	-0.5 ± 1.1 mph	-0.2 ± 1.2 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.2 ft	-0.1 ± 0.1 ft

From Table 6-2, it can be seen that all weights are underestimated consistently throughout the entire temperature range. Variability appears to be greater at the high end of the temperature range for all weights.

Figure 6-5 shows the distribution of GVW Errors versus Temperature by Truck. The equipment appears to produce a slight underestimation of GVW for the golden truck (squares) over the observed temperature range. For the partial truck (diamonds), the equipment appears to estimate with reasonable accuracy at the lower temperatures, and underestimate at the higher temperatures. The variability in error for both trucks appears to be similar over the entire temperature range.

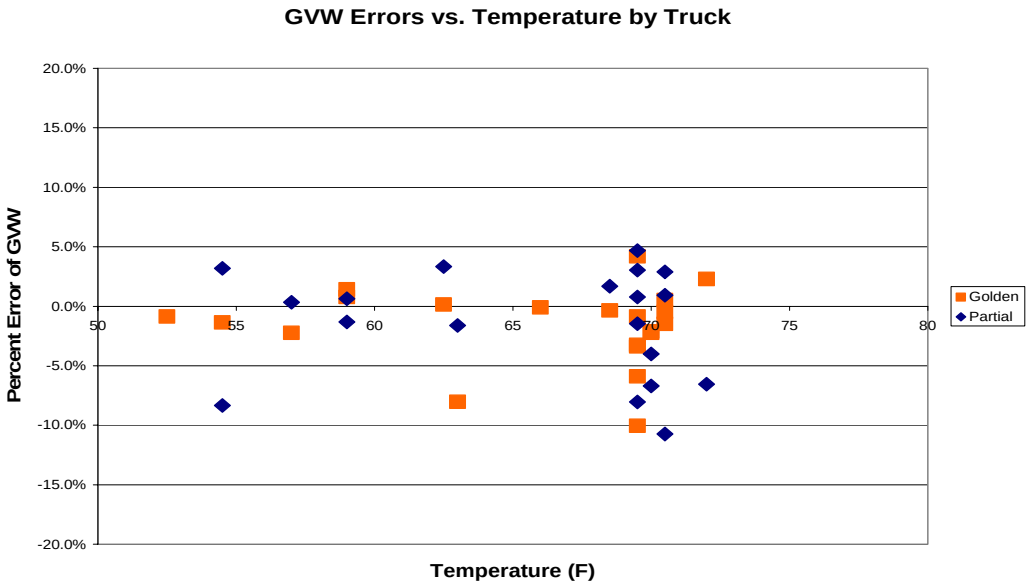


Figure 6-5 Pre-Validation GVW Percent Error vs. Temperature by Truck – 200200 – 17-Apr-2007

Figure 6-6 shows the relation between steering axle errors and temperature. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for auto-calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles.

The figure shows that steering axle weights are generally overestimated by the equipment at the lower end of the temperature range, and underestimated at the higher end of the temperature range. Variability in error appears to be greater at the higher end of the temperature range when compared to lower end.

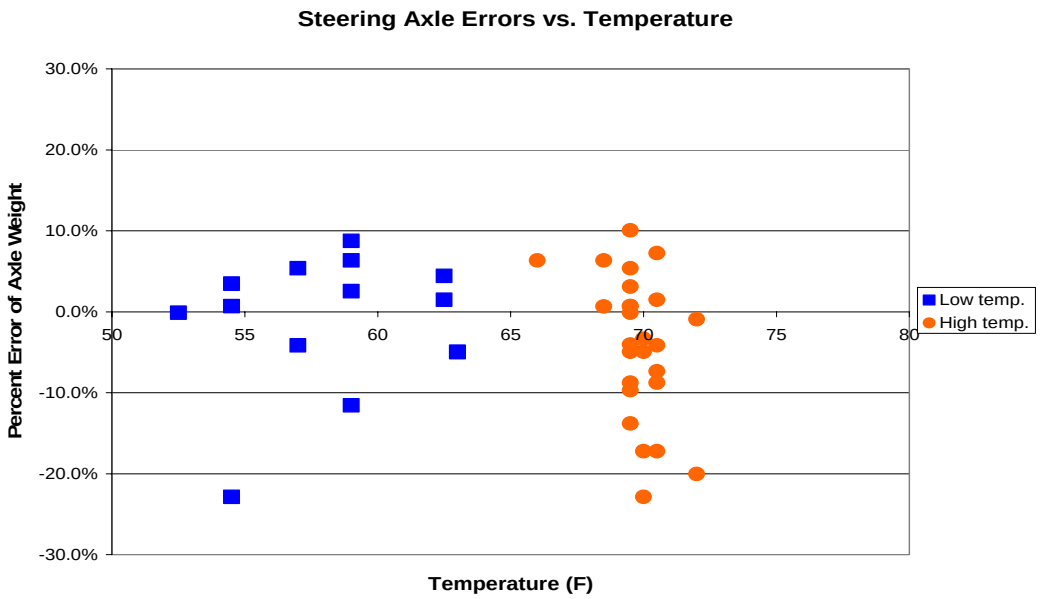


Figure 6-6 Pre-Validation Steering Axle Error vs. Temperature by Group – 200200 – 17-Apr-2007

6.2 Speed-based Analysis

The speed groups were divided as follows: Low speed – 53 to 59 mph, Medium speed – 60 to 67 mph and High speed – 68+ mph.

Table 6-3 Pre-Validation Results by Speed Bin – 200200 – 17-Apr-2007

Element	95% Limit	Low Speed 53 to 59 mph	Medium Speed 60 to 67 mph	High Speed 68+ mph
Steering axles	±20 %	0.5 ± 14.5%	-2.6 ± 15.6%	-7.6 ± 23.3%
Tandem axles	±15 %	0.3 ± 6.5%	-2.3 ± 11.5%	-1.5 ± 14.5%
GVW	±10 %	0.3 ± 5.2%	-2.4 ± 9.4%	-2.6 ± 9.6%
Speed	±1 mph	-0.2 ± 0.9 mph	-0.4 ± 1.4 mph	-0.3 ± 1.4 mph
Axle spacing	± 0.5 ft	-0.1 ± 0.2 ft	-0.1 ± 0.1 ft	-0.1 ± 0.1 ft

From Table 6-3, it can be seen that the underestimation and variability in error for all weights generally increases as speed increases.

Figure 6-7 illustrates the tendency of the equipment to overestimate GVW for both trucks at low speeds and underestimate GVW for both trucks at medium and high speeds. Variability in GVW error appears to be greater at medium and high speeds when compared with low speeds.

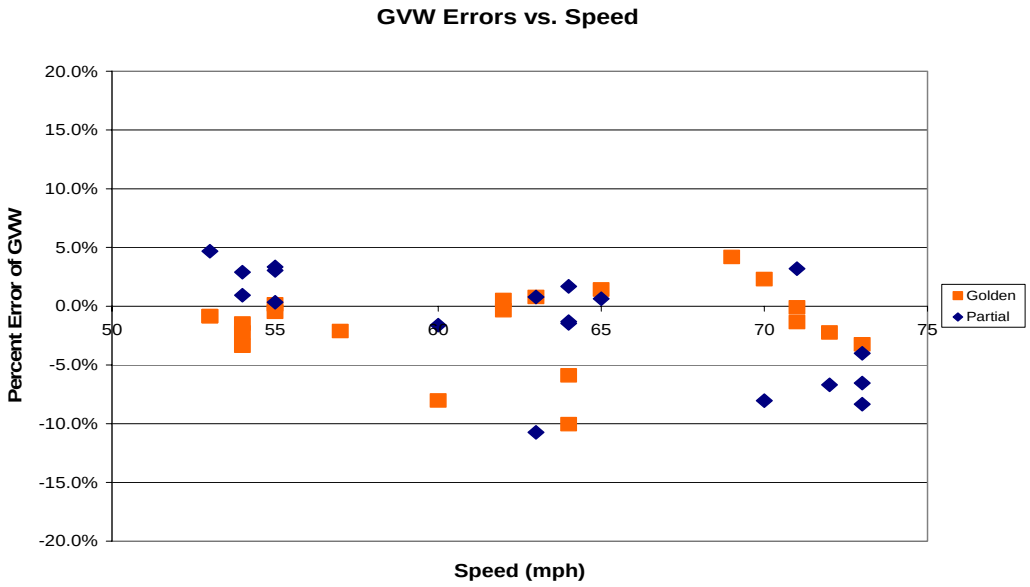


Figure 6-7 Pre-Validation GVW Percent Error vs. Speed Group - 200200 –17-Apr-2007

Figure 6-8 shows the relation between steering axle errors and speed. This graph is included due to the frequent use of steering axle weights of Class 9 vehicles for calibration. This site does not use auto-calibration. The steering axles in this graph are associated only with Class 9 vehicles.

From the figure, it appears that the equipment generally overestimates steering axle weights at lower speeds, and then increasingly underestimates steering axle weights as speed increases. Variability in steering axle error appears to be reasonably consistent throughout the entire speed range.

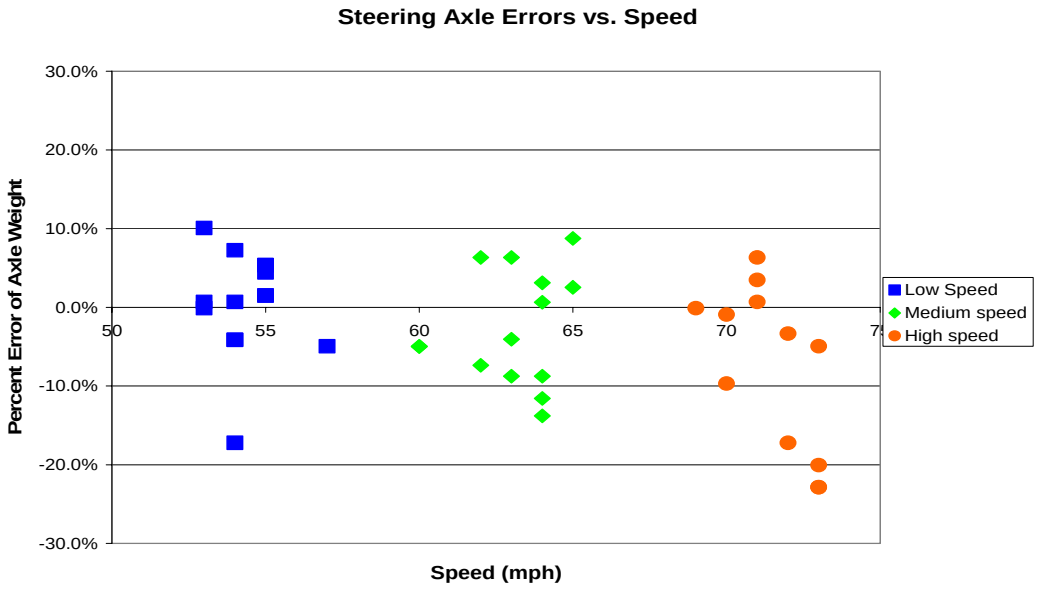


Figure 6-8 Pre-Validation Steering Axle Percent Error vs. Speed Group - 200200 – 17-Apr-2007

6.3 Classification Validation

This LTPP installed site uses the FHWA 13-bin classification scheme and the LTPP classification algorithm. Classification 15 has been added to define unclassified vehicles.

The classification validation is intended to find gross errors in vehicle classification, not to validate the installed algorithm. A sample of 100 was collected at the site. The classification identification is to identify gross errors in classification, not validate the classification algorithm. Video was taken at the site to provide ground truth for the evaluation. Based on a 100 percent sample it was determined that there are 0 percent unknown vehicles and 0 percent unclassified vehicles.

The second check is the ability of the algorithm to correctly distinguish between truck classes with no more than 2% errors in such classifications. Table 6-4 has the classification error rates by class. The overall misclassification rate is 2 percent.

Table 6-4 Truck Misclassification Percentages for 200200 – 17-Apr-2007

Class	Percent Error	Class	Percent Error	Class	Percent Error
4	N/A	5		6	N/A
7	N/A				
8	0	9	1	10	N/A
11	14	12	0	13	N/A

The misclassification percentage is computed as the probability that a pair containing the class of interest does NOT include a match. Thus if there are eight pairs of observations with at least one Class 9 and only six of them are matches, the error rate is 25 percent.

The percent error and the mean differences reported below do not represent the same statistic. It is possible to have error rates greater than 0 with a mean difference of zero.

Table 6-5 Truck Classification Mean Differences for 200200 – 17-Apr-2007

Class	Mean Difference	Class	Mean Difference	Class	Mean Difference
4	N/A	5		6	N/A
7	N/A				
8	0	9	-1	10	N/A
11	17	12	N/A	13	0

These error rates are normalized to represent how many vehicles of the class are expected to be over- or under-counted for every hundred of that class observed by the equipment. Thus a value of 0 means the class is identified correctly on average. A number between –1 and –100 indicates at least that number of vehicles either missed or not assigned to the class by the equipment. It is not possible to miss more than all of them or one hundred out of one hundred. Numbers 1 or larger indicate at least how many more vehicles are assigned to the class than the actual "hundred observed". Classes marked Unknown are those identified by the equipment but no vehicles of the type were seen the observer. There is no way to tell how many vehicles of that type might actually exist. N/A means no vehicles of the class were recorded by either the equipment or the observer. The misclassifications of the class 9 and 11 trucks were due to an equipment malfunction where "ghost" axles were being detected as valid axles by the equipment. The malfunction was rectified prior to performing the post-validation classification study. Assistance was provided by the manufacturer's installer remotely. The threshold level of the system was raised which prevented the system from identifying signal ringing as valid axle hits. This adjustment was made prior to completing the pre-validation runs. The actual reporting of "ghost" axles cannot be determined on the basis of this information.

6.4 Evaluation by ASTM E-1318 Criteria

The ASTM E-1318 criteria for a successful validation of Type I sites is 95% of the observed errors within the limits for allowable errors for each of the relevant statistics. If this site had been evaluated using ASTM E-1318-02 it would not have met the conditions for a Type I site exclusive of wheel loads. LTPP does not validate WIM performance with respect to wheel loads.

Table 6-6 Results of Validation Using ASTM E-1318-02 Criteria

Characteristic	Limits for Allowable Error	Percent within Allowable Error	Pass/Fail
Single Axles	± 20%	92.5%	Fail
Axle Groups	± 15%	98.8%	Pass
GVW	± 10%	95%	Pass

6.5 Prior Validations

The last validation for this site was done October 31 to November 1, 2006. It was the first validation of the site. The site was producing research quality data. Figure 6-9 shows the GVW Percent Error vs. Speed for the post validation runs. The site was validated with two trucks. The "Golden" truck was loaded to 77,290 lbs. The "partial" truck which had an air suspension on both tandems was loaded to 64,850 lbs.

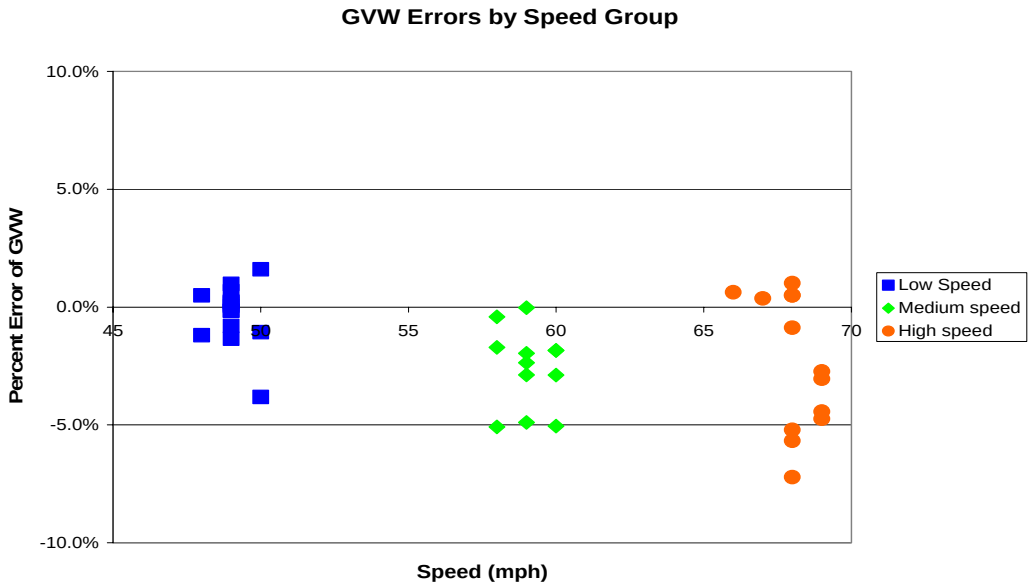


Figure 6-9 Last Validation GVW Percent Error vs. Speed – 200200 – 31-Oct-2006

Table 6-7 shows the overall results from the last validation. It should be noted that will the bias was essentially the same, the variability of the errors nearly doubled from the previous visit.

Table 6-7 Last Validation Final Results – 200200 – 31-Oct-2006

SPS-1, -2, -5, -6 and -8	95 %Confidence Limit of Error	Site Values	Pass/Fail
Steering axles	±20 percent	-4.8 ± 7.7%	Pass
Tandem axles	±15 percent	-1.1 ± 5.8%	Pass
Gross vehicle weights	±10 percent	-1.6 ± 4.6%	Pass
Speed	±1 mph [2 km/hr]	**0.0 ± 1.4 mph**	**Fail**
Axle spacing	± 0.5 ft [150 mm]	0.0 ± 0.1 ft	Pass

Table 6-8 has the results at the end of the last validation by temperature. Cloudy weather conditions resulted in a very narrow range of temperatures during that test period. Through the current validation the equipment has been observed at temperatures from 52 to 94 degrees Fahrenheit.

Table 6-8 Last Validation Results by Temperature Bin – 200200 – 31-Oct-2006

Element	95% Limit	Medium Temperature 48 to 61 °F
Steering axles	±20 %	-4.8 ± 7.7%
Tandem axles	±15 %	-1.1 ± 5.8%
GVW	±10 %	-1.6 ± 4.6%
Speed	±1 mph	**0.0 ± 1.4 mph**
Axle spacing	± 0.5 ft	0.0 ± 0.1 ft

Table 6-9 has the results of the prior post validation by speed groups. It can be seen that the equipment estimated tandem axle weights and GVW reasonably well at the lower speeds. For steering axles, the equipment tends to underestimate the weights at all speeds, and by a higher degree at medium and high speeds. Variability in tandem axle weight and GVW errors increases as speed increases. Steering axle variability is slightly greater at medium and high speeds when compared with low speeds.

Table 6-9 Last Validation Results by Speed Bin – 200200 – 31-Oct-2006

Element	95% Limit	Low Speed mph	Medium Speed Mph	High Speed mph
Steering axles	±20 %	-2.9 ± 6%	-7.7 ± 8.3%	-4.4 ± 7.4%
Tandem axles	±15 %	0.2 ± 4.3%	-1.7 ± 5.8%	-2 ± 7.1%
GVW	±10 %	-0.3 ± 2.7%	-2.6 ± 3.7%	-2.4 ± 6.3%
Speed	±1 mph	0.1 ± 1.3 mph	-0.2 ± 1.6 mph	0.1 ± 1.7 mph
Axle spacing	± 0.5 ft	0.0 ± 0.2 ft	0.0 ± 0.1 ft	-0.1 ± 0.1 ft

7 Data Availability and Quality

As of April 17, 2007 this site does not have at least 5 years of research quality data. Research quality data is defined to be at least 210 days in a year of data of known calibration meeting LTPP's precision requirements.

Data that has validation information available has been reviewed in light of the patterns present in the two weeks immediately following a validation/calibration activity. A determination of research quality data is based on the consistency with the validation pattern. Data that follows consistent and rational patterns in the absence of calibration information may be considered nominally of research quality pending validation information with which to compare it. Data that is inconsistent with expected patterns and has no supporting validation information is not considered research quality.

The amount and coverage for the site is shown in Table 7-1. The value for months is a measure of the seasonal variation in the data. The indicator of coverage indicates whether day of week variation has been accounted for on an annual basis. As can be seen from the table none of the years have a sufficient quantity to be considered complete years of data. Together with the previously gathered calibration information it can be seen that at least 5 additional years of research quality data are needed to meet the goal of a minimum of 5 years of research weight data.

Table 7-1 Amount of Traffic Data Available 200200 – 17-Apr-2007

Year	Classification Days	Months	Coverage	Weight Days	Months	Coverage
1992	191	9	Full Week	79	4	Full Week
1993	70	5	Full Week	51	4	Full Week
1994	104	4	Full Week	4	1	Weekdays and weekend days

GVW graphs and characteristics associated with them are used as data screening tools. As a result classes constituting more that ten percent of the truck population are considered major sub-groups whose evaluation characteristics should be identified for use in screening. The typical values to be used for reviewing incoming data after a validation are determined starting with data from the day after the completion of a validation.

Class 9s and Class 5s constitute more than 10 percent of the truck population. Based on the data collected from the end of the last calibration iteration the following are the expected values for these populations. The precise values to be used in data review will need to be determined by the RSC on receipt of the first 14 days of data after the successful validation. For sites that do not meet LTPP precision requirements, this period may still be used as a starting point from which to track scale changes.

Table 7-2 is generated with a column for every vehicle class 4 or higher that represents 10 percent or more of the truck (class 4-20) population. In creating Table 7-2 the following definitions are used:

- Class 9 overweights are defined as the percentage of vehicles greater than 88,000 pounds
- Class 9 underweights are defined as the percentage of vehicles less than 20,000 pounds.
- Class 9 unloaded peak is the bin less than 44,000 pounds with the greatest percentage of trucks.
- Class 9 loaded peak is the bin 60,000 pounds or larger with the greatest percentage of trucks.
- For all other trucks the typical axle configuration is used to determine the maximum allowable weight based on 18,000 pounds for single axles and 34,000 pounds for

tandem axles. A ten percent cushion above that maximum is used to set the overweight threshold.

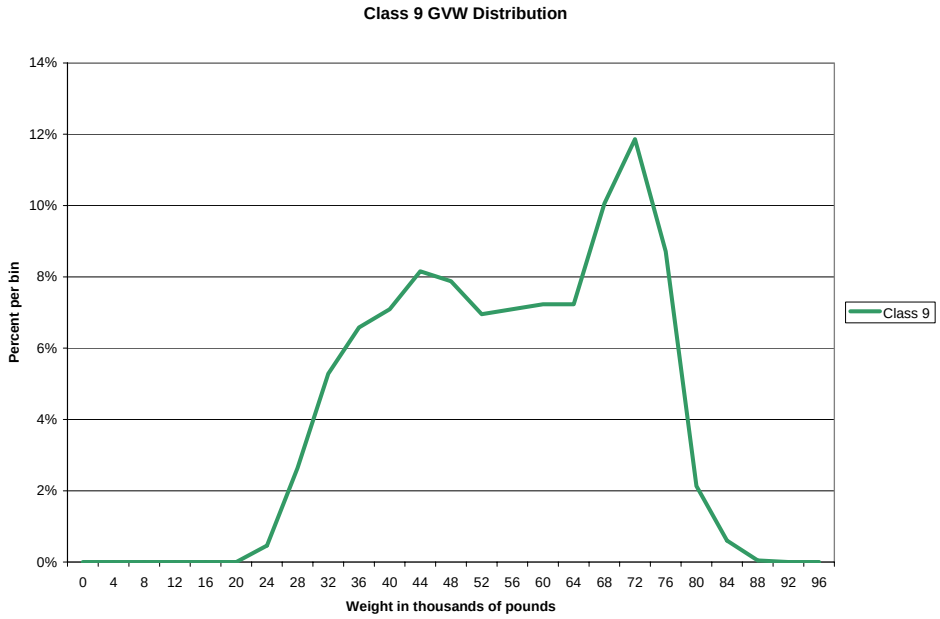
- For all other trucks in the absence of site specific information the computation of under weights assumes the power unit weighs 10,000 pounds and each axle on a trailer 5,000 pounds. Ninety percent of the total for the unloaded configuration is the value below which a truck is considered under weight.
- For all trucks other than class 9s that have a bi-modal distribution the unloaded peak is defined to be in a bin less than or equal to half of the allowable maximum weight.
- For all trucks other than class 9s that have a bi-modal distribution the loaded peak is defined to be in a bin greater than or equal to half of the allowable maximum weight.

There may be more than one bin identified for the unloaded or loaded peak due to the small sample size collected after validation. Where only one peak exists, the peak rather than a loaded or unloaded peak is identified. This may happen with single unit trucks. It is not expected to occur with combination vehicles.

Table 7-2 GVW Characteristics of Major sub-groups of Trucks – 200200 – 18-Apr-2007

Characteristic	Class 5	Class 9
Percentage Overweights	0.0	0.0
Percentage Underweights	2.9	0.0
Unloaded Peak		36,000 lbs
Loaded Peak		80,000 lbs
Peak	12,000 lbs	

The expected percentage of unclassified vehicles is 2.1%. This is based on the percentage of unclassified vehicles in the post-validation data



download.

Figure 7-1 through Figure 7-3. These are based on data collected immediately after the validation and may not be wholly representative of the population at the site. They should however provide a sense of the statistics expected when SPS comparison data is computed for the Post-Validation Sheet 16.

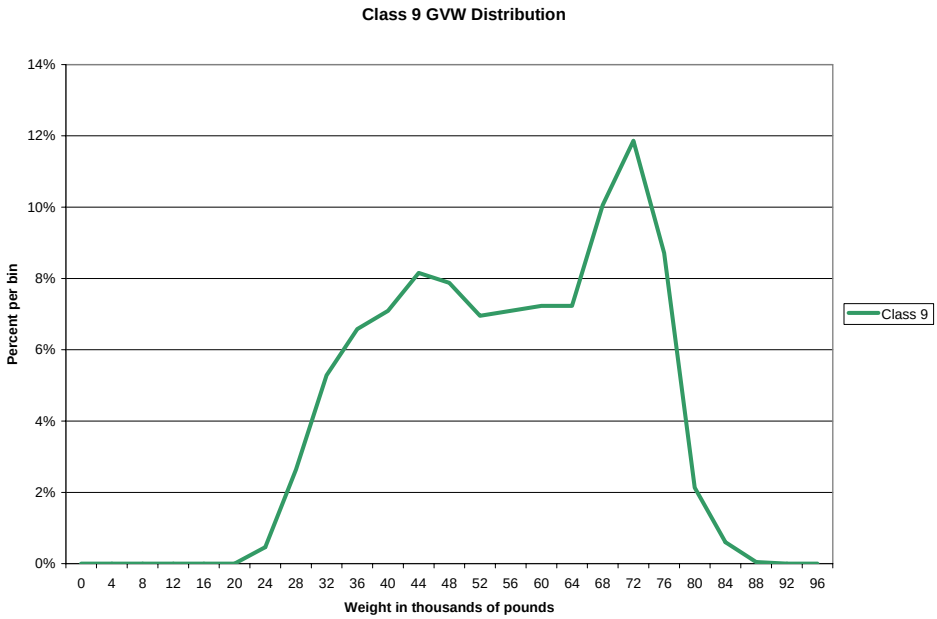


Figure 7-1 Expected GVW Distribution Class 9 – 200200 – 18-Apr-2007

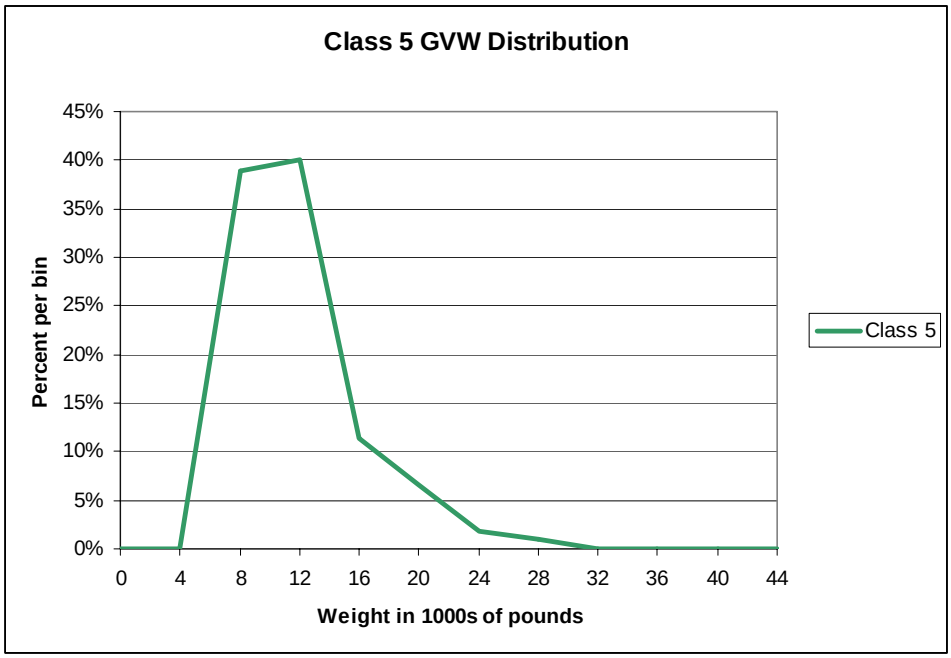


Figure 7-2 Expected GVW Distribution Class 5 – 200200 – 18-Apr-2007

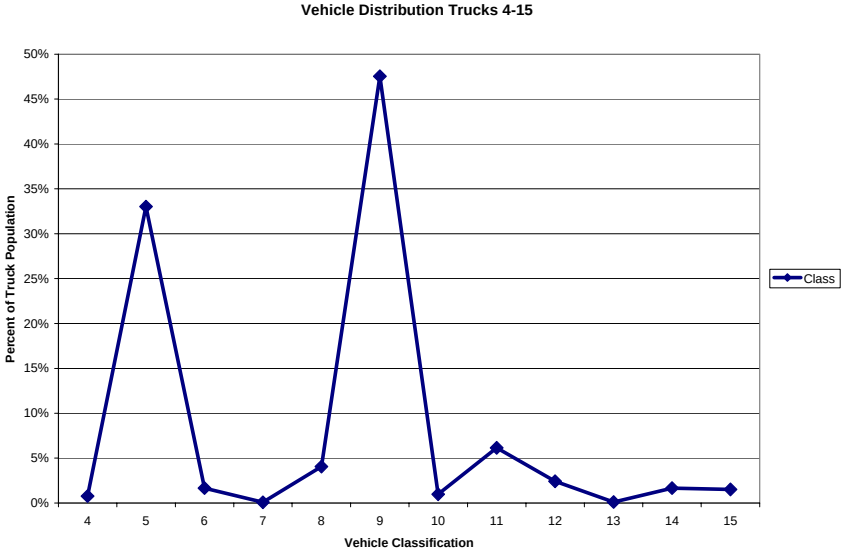


Figure 7-3 Expected Vehicle Distribution – 200200 – 18-Apr-2007

8 Data Sheets

The following is a listing of data sheets incorporated in Appendix A.

Sheet 19 – Truck 1 – 3S2 loaded air suspension (4 pages)
Sheet 19 – Truck 2 – 3S2 partially loaded air suspension tractor and leaf suspension trailer (4 pages)

Sheet 20 – Speed and Classification verification – Pre-Validation (2 pages)
Sheet 20 – Speed and Classification verification – Post-Validation (2 pages)

Sheet 21 – Pre-Validation (3 pages)
Sheet 21 – Calibration Iteration 1 – (1 page)
Sheet 21 – Post-Validation (3 pages)

Calibration Iteration 1 Worksheets – (1 page)

Test Truck Photographs (6 pages)

LTPP Mod 3 Classification Scheme 9 (1 page)

Final System Parameters – (1 page)

9 Updated Handout Guide and Sheet 17

A copy of the handout has been included following the next page. It includes a current Sheet 17 with all applicable maps and photographs. There are no significant changes in the information provided in the Pre-Visit Handout Guide.

10 Updated Sheet 18

A current Sheet 18 indicating the contacts, conditions for assessments and evaluations has been attached following the updated handout guide.

11 Traffic Sheet 16(s)

Sheet 16s for the Pre-Validation and Post-Validation conditions are attached following the current Sheet 18 information at the very end of the report.

POST-VISIT HANDOUT GUIDE FOR SPS WIM FIELD VALIDATION

STATE: Kansas

SHRP ID: 0200

Figures

1. General Information

SITE ID: *200200*

LOCATION: *Interstate 70 West at M.P. 287.48*

VISIT DATE: *April 17 and 18, 2007*

VISIT TYPE: *Validation*

2. Contact Information

POINTS OF CONTACT:

Validation Team Leader: *Dean J. Wolf, 301-210-5105, djwolf@mactec.com*

Highway Agency: *Bill Hughes, 785-296-6863, bhughes@ksdot.org*

Bill Parcells, 785-291-3846, billp@ksdot.org

FHWA COTR: *Debbie Walker, 202-493-3068, deborah.walker@fhwa.dot.gov*

FHWA Division Office Liaison: *Kirk Fredrichs, 785-267-7299 x326, kirk.fredrichs@fhwa.dot.gov*

LTPP SPS WIM WEB PAGE: *http://www.tfhrc.gov/pavement/ltpp/spstraffic/index.htm*

3. Agenda

BRIEFING DATE: *No briefing has been requested at this time*

ON SITE PERIOD: *April 17 and 18, 2007*

TRUCK ROUTE CHECK: *Completed at previous Validation. See Truck Route.*

4. Site Location/ Directions

NEAREST AIRPORT: *Kansas City International Airport, Kansas City, Kansas.*

DIRECTIONS TO THE SITE: *1 mile West of Chapman Interchange, East of Abilene, Kansas*

MEETING LOCATION: *On site at 9:00am, April 17, 2007*

WIM SITE LOCATION: *Interstate 70 West at M.P. 287.48* (*Latitude: 38.9902^0 and Longitude: 97.9992^0*)

WIM SITE LOCATION MAP:*See Figure 4.1*

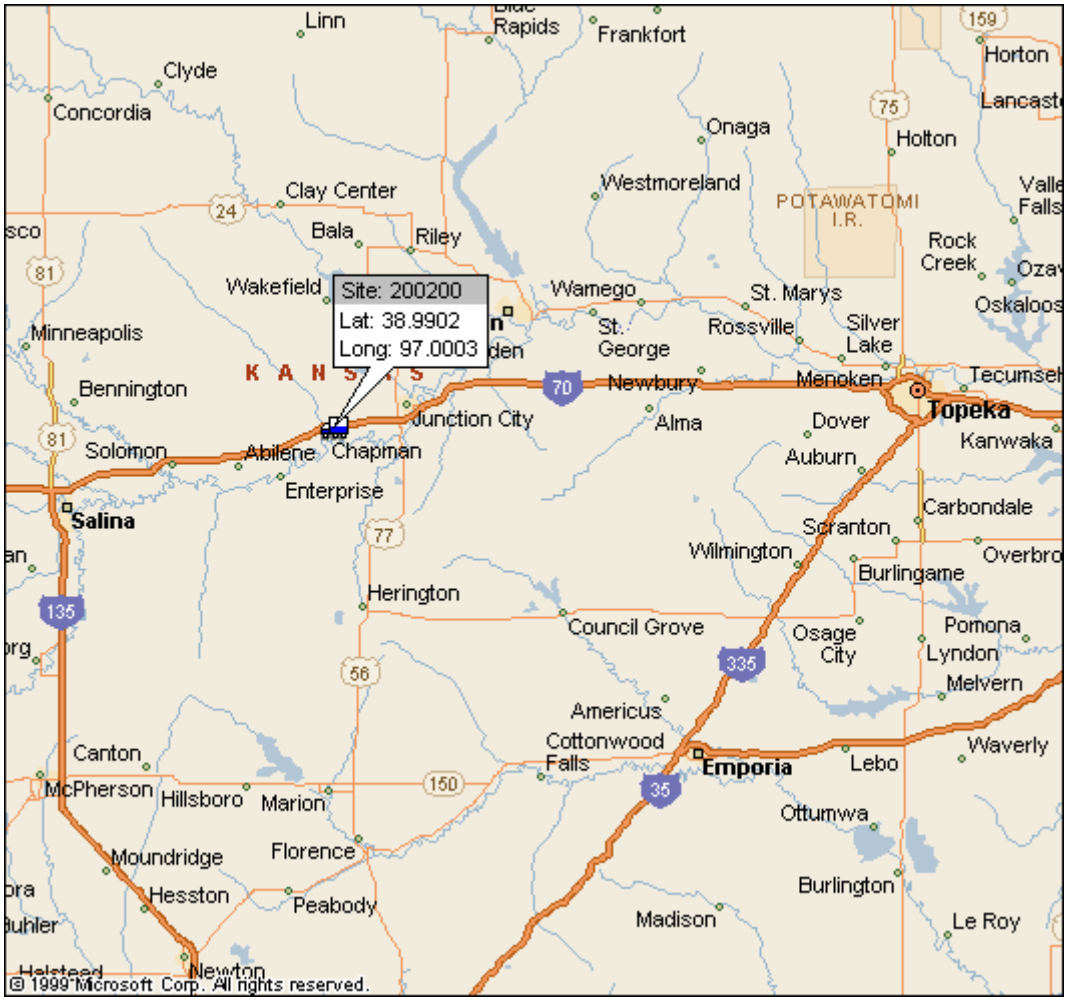


Figure 4-1: Site 200200 Location in Kansas

5. Truck Route Information

ROUTE RESTRICTIONS: *None.*

SCALE LOCATION: *De Bruce Grain, 513 W. First St., Abilene, Kansas. Manager – Brent Martin, phone: (785) 263-7275. Open from 7:30 a.m. to 5:00 p.m. (14.1 miles from site)*

TRUCK ROUTE:

East – 2.7 miles to exit 290 on I-70 (Milford Lake Road)
West – 1.1 miles to exit 286 on I-70 (Chapman)
Length of truck turnaround is 3.8 miles

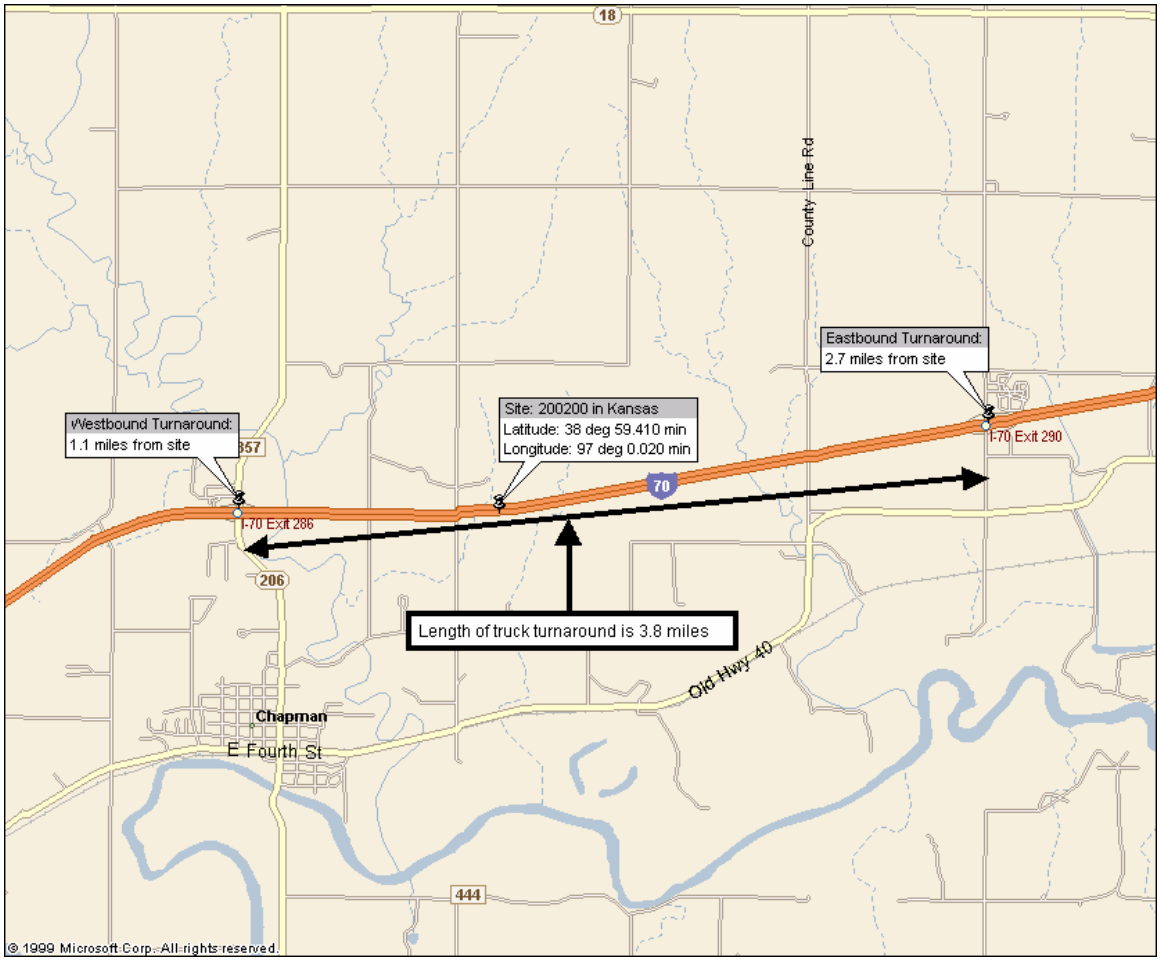


Figure 5-1: Truck Route of 200200 in Kansas

6. Sheet 17 – Kansas (200200)

1.* ROUTE ___I-70_____MILEPOST ___287.48__LTPP DIRECTION - N S E W

2.* WIM SITE DESCRIPTION - Grade __~ 1_____ % Sag vertical Y / N
Nearest SPS section upstream of the site ____2_0_0_2_1_2_____
Distance from sensor to nearest upstream SPS Section ___7_8_2_ _____ ft

3.* LANE CONFIGURATION
Lanes in LTPP direction __2__ Lane width _1_2_ ft

Median - 1 – painted
2 – physical barrier
3 – grass
4 – none

Shoulder - 1 – curb and gutter
2 – paved AC
3 – paved PCC
4 – unpaved
5 – none

Shoulder width _10_____ ft

4.* PAVEMENT TYPE _____Portland Cement Concrete_____

5.* PAVEMENT SURFACE CONDITION – Distress Survey
Date _04/17/07_ Filename: Upstream_TO_18_20_2.86_0200_04_17_07.jpg_
Date _04/17/07_ Filename: Downstream_TO_18_20_2.86_0200_04_17_07.jpg_
Date _____ Filename: _____

6. * SENSOR SEQUENCE _____loop – weighpad – weighpad – loop ____

7. * REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __
REPLACEMENT AND/OR GRINDING __ __ __ / __ __ / __ __ __ __

8. RAMPS OR INTERSECTIONS
Intersection/driveway within 300 m upstream of sensor location Y / N distance _____
Intersection/driveway within 300 m downstream of sensor location Y / N distance _____
Is shoulder routinely used for turns or passing? Y / N

9. DRAINAGE (*Bending plate and load cell systems only)* 1 – Open to ground
2 – Pipe to culvert
3 – None

Clearance under plate ___ _4.0__ in
Clearance/access to flush fines from under system Y / N

10. * CABINET LOCATION

Same side of road as LTPP lane Y / N Median Y/ N Behind barrier Y / N

Distance from edge of traveled lane _7_2_ ft

Distance from system ___7_8_ ft

TYPE _____3R_____

CABINET ACCESS controlled by LTPP / STATE / JOINT?

Contact - name and phone number _Bill Hughes (785) 296-6863 ____

Alternate - name and phone number Bill Parcells (785) 291-3846 _____

11. * POWER

Distance to cabinet from drop ___4_3_8_____ ft Overhead / underground / solar / AC in cabinet?

Service provider _____ Phone number _____

12. * TELEPHONE

Distance to cabinet from drop ____1_____ ft Overhead / underground / cell?

Service provider _____ Phone Number_(785) 922-6231___

13.* SYSTEM (software & version no.)-____iSINC_____

Computer connection – RS232 / Parallel port / USB / Other _____

14. * TEST TRUCK TURNAROUND time __12_____ minutes DISTANCE _7.6_mi.

15. PHOTOS FILENAME

Power source _Power_Meter_TO_18_20_2.86_0200_04_17_07.jpg_____
_Service_Post_TO_18_20_2.86_0200_04_17_07.jpg_____

Phone source _Telephone_Pedestal_TO_18_20_2.86_0200_04_17_07.jpg_____
_Telephone_Drop_TO_18_20_2.86_0200_04_17_07.jpg_____

Cabinet exterior _Cabinet_Exterior_TO_18_20_2.86_0200_04_17_07.jpg_____

Cabinet interior _Cabinet_Interior_Front_TO_18_20_2.86_0200_04_17_07.jpg__
_Cabinet_Interior_Back_TO_18_20_2.86_0200_04_17_07.jpg___

Weight sensors _Leading_WIM_Sensor_TO_18_20_2.86_0200_04_17_07.jpg___
_Trailing_WIM_Sensor_TO_18_20_2.86_0200_04_17_07.jpg____

Classification sensors _____

Other sensors _Loop sensors_____

Description _Leading_Loop_TO_18_20_2.86_0200_04_17_07.jpg_____
_Trailing_Loop_TO_18_20_2.86_0200_04_17_07.jpg_____

Downstream direction at sensors on LTPP lane

__ Downstream_TO_18_20_2.86_0200_04_17_07.jpg___

Upstream direction at sensors on LTPP lane

___ Upstream_TO_18_20_2.86_0200_04_17_07.jpg_____

COMMENTS _ _____
_____GPS Coordinates: Latitude: 38.9902^0 and Longitude: 97.9992^0
_____
_____
_____Amenities:_____
_____
_____West: exit 275 on I-70, Abilene – 12.1 miles from site_____
_____BP Gas, Holiday Inn Express, Super 8, various restaurants_____
_____
_____East: exit 295 on I-70 – 6.9 miles from site_____
_____Motel 6, Phillips 66 Gas, Conoco Gas_____
_____
_____exit 296 on I-70 – 8.5 miles from site_____
_____Comfort Inn, Ramada Ltd, Days Inn, various gas stations & restaurants_____
_____
_____exit 298 on I-70 – 9.9 miles from site_____
_____Holiday Inn Express, various gas stations & restaurants, Wal-Mart_____
_____
_____Speed Limit – 70 mph_____
_____Site Phone No: 785-922-6420_____
_____
_____
____ Test Truck Recommendations: _____
_____Types of Trucks: Two Class 9s_____
___Truck 1: Class 9, 72,000 to 80,000 legal limit on gross and axles, air suspension_____
_____
_____Truck 2: Class 9, 45,000 to 55,000 lbs_____
_____
_____ Expected Speeds:55, 60, 65 and 70 mph_____
_____
___broken conduit_____
___caved in trench_____
_____
_____
_____
_____
_____
_____
_____
_____

COMPLETED BY _____Dean J. Wolf_____

PHONE __301-210-5105___DATE COMPLETED _0_4_ /_1 7_ / _2_0_0_7_

Sketch of equipment layout

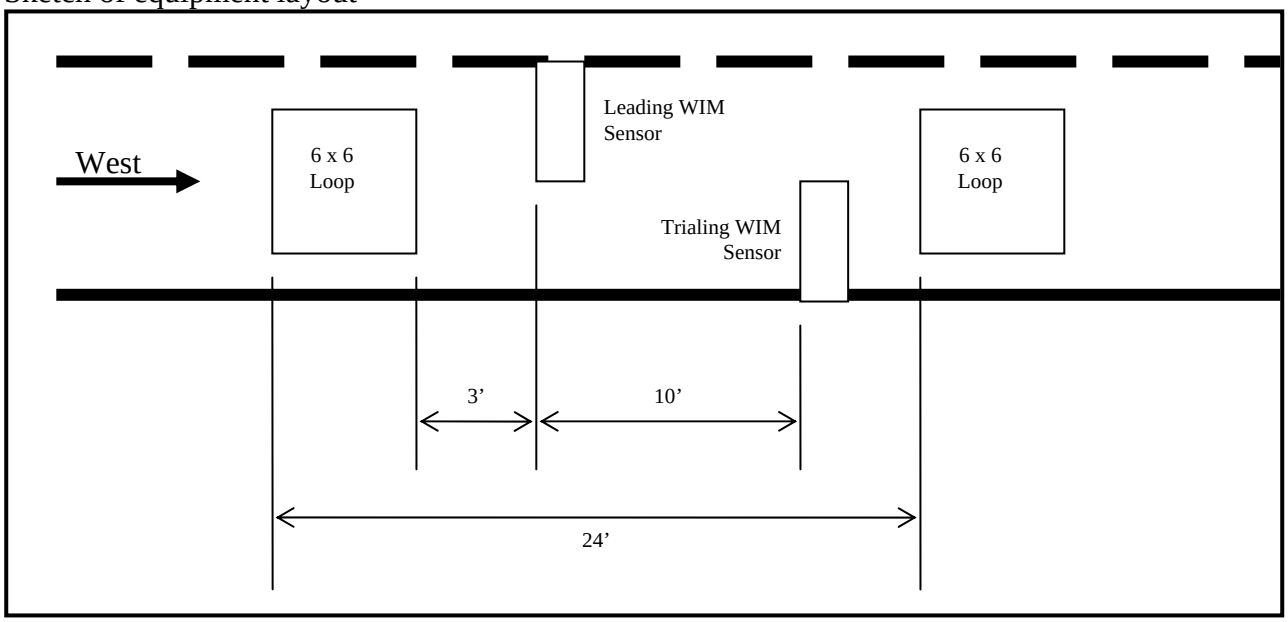


Figure 6-1 – Equipment Layout of Site 200200 in Kansas

Site Map

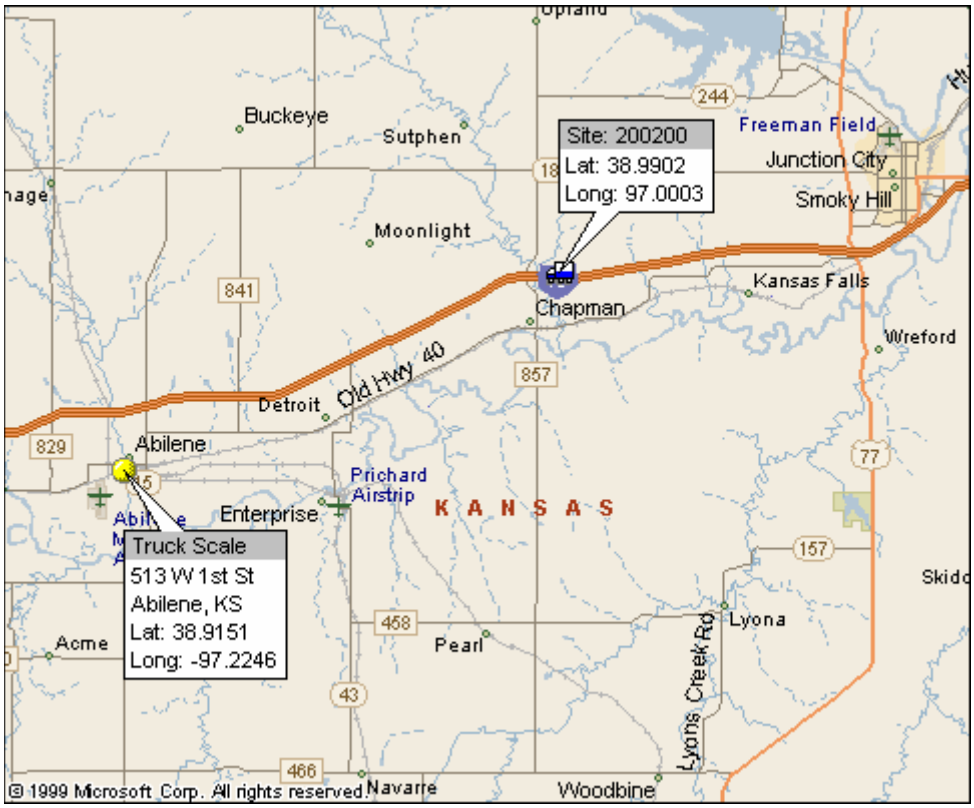


Figure 6-2: Site Map of 200200 in Kansas

Figure 6-2 Upstream_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-3 Downstream_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-4 Cabinet_Exterior_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-5 Cabinet_Interior_Front_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-6 Cabinet_Interior_Back_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-7 Leading_Loop_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-8 Leading_WIM_Sensor_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-9 Trailing_WIM_Sensor_TO_18_20_2.86_0200_04_17_07.jpg

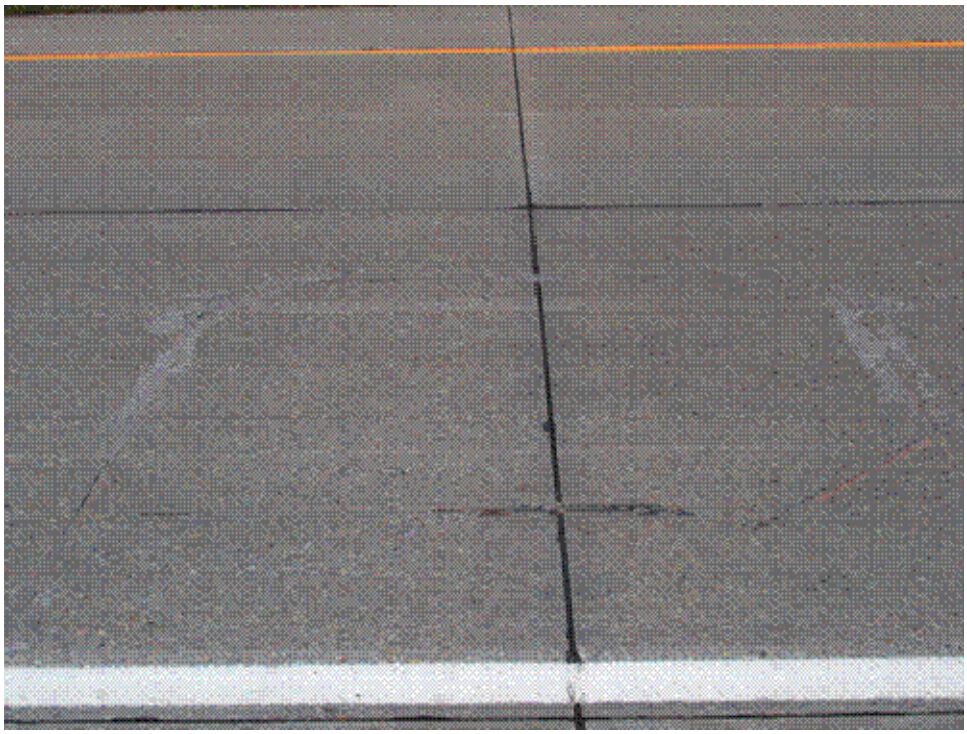


Figure 6-10 Trailing_Loop_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-11 Power_Meter_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-12 Service_Post_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-13 Telephone_Pedestal_TO_18_20_2.86_0200_04_17_07.jpg

Figure 6-14 Telephone_Drop_TO_18_20_2.86_0200_04_17_07.jpg

SHEET 18	STATE CODE	[_2_0_]
LTPP MONITORED TRAFFIC DATA	SPS PROJECT ID	[_0_2_0_0_]
WIM SITE COORDINATION	DATE: (mm/dd/yyyy)	_0_4_ / _1_7_ / _2_0_0_7_

Rev. 05/25/04

1. DATA PROCESSING –
   a. Down load –
      - □ State only
      - □ LTPP read only
      - □ LTPP download
      - ■ LTPP download and copy to state

   b. Data Review –
      - □ State per LTPP guidelines
      - □ State – □ Weekly □ Twice a Month □ Monthly □ Quarterly
      - ■ LTPP

   c. Data submission –
      - □ State – □ Weekly □ Twice a month □ Monthly □ Quarterly
      - ■ LTPP

2. EQUIPMENT –
   a. Purchase –
      - ■ State
      - □ LTPP

   b. Installation –
      - ■ Included with purchase
      - □ Separate contract by State
      - □ State personnel
      - □ LTPP contract

   c. Maintenance –
      - □ Contract with purchase – Expiration Date _____
      - □ Separate contract LTPP – Expiration Date _____
      - □ Separate contract State – Expiration Date _____
      - ■ State personnel

   d. Calibration –
      - ■ Vendor
      - □ State
      - □ LTPP

   e. Manuals and software control –
      - ■ State
      - □ LTPP

   f. Power –
      i. Type –
         - □ Overhead
         - ■ Underground
         - □ Solar

      ii. Payment –
         - ■ State
         - □ LTPP
         - □ N/A

g. Communication –
   i. Type –
      ■ Landline
      □ Cellular
      □ Other
   ii. Payment –
      ■ State
      □ LTPP
      □ N/A

3. PAVEMENT –
   a. Type –
      ■ Portland Concrete Cement
      □ Asphalt Concrete

   b. Allowable rehabilitation activities –
      ■ Always new
      □ Replacement as needed
      □ Grinding and maintenance as needed
      □ Maintenance only
      □ No remediation

   c. Profiling Site Markings –
      □ Permanent
      ■ Temporary

4. ON SITE ACTIVITIES –
   a. WIM Validation Check - advance notice required __1___ □ days ■ weeks

   b. Notice for straightedge and grinding check - ___1___ □ days ■ weeks
      i. On site lead –
         ■ State
         □ LTPP

      ii. Accept grinding –
         ■ State
         □ LTPP

   c. Authorization to calibrate site –
         □ State only
         ■ LTPP

   d. Calibration Routine –
         ■ LTPP – ■ Semi-annually □ Annually
         □ State per LTPP protocol – □ Semi-annually □ Annually
         □ State other – _____

e. Test Vehicles

i. Trucks –

1st – Air suspension 3S2	□ State	■ LTPP
2nd – _3S2 _____	□ State	■ LTPP
3rd – _____	□ State	□ LTPP
4th – _____	□ State	□ LTPP

ii. Loads – □ State ■ LTPP

iii. Drivers – □ State ■ LTPP

f. Contractor(s) with prior successful experience in WIM calibration in state:

_____Hammell Scale_____

g. Access to cabinet

i. Personnel Access –

□ State only
■ Joint
□ LTPP

ii. Physical Access –

■ Key
□ Combination

h. State personnel required on site – ■Yes □No

i. Traffic Control Required – □Yes ■No

j. Enforcement Coordination Required – □Yes ■No

5. SITE SPECIFIC CONDITIONS –

a. Funds and accountability – _____

b. Reports – _____

c. Other – _____

d. Special Conditions – _____

6. CONTACTS –

a. Equipment (operational status, access, etc.) –

Name: _____Roy Czinku _____ Phone:(306) 653-6627_____

Agency: _____IRD/PAT Traffic_____

b. Maintenance (equipment) –

Name: ___Bill Hughes _____ Phone:(785) 296-6863

Agency: _____

c. Data Processing and Pre-Visit Data –

Name: ____Bill Hughes _____ Phone:(785) 296-6863__

Agency: _____

d. Construction schedule and verification –

Name: ____Bill Hughes _____ Phone: (785) 296-6863

Agency: _____

e. Test Vehicles (trucks, loads, drivers) –

Name: __DeBruce Grain _____ Phone: __785-263-7275____

Agency: __Brent Martin _____

f. Traffic Control –

Name: _____ Phone: _____

Agency: _____

g. Enforcement Coordination –

Name: _____ Phone: _____

Agency: _____

h. Nearest Static Scale

Name: De Bruce Grain Location: 513 W. First St., Abilene, Kansas

Phone: Manager – Brent Martin, phone: (785) 263-7275

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [20] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [4/17/2007]

2. * TYPE OF EQUIPMENT CALIBRATED ____ WIM ____ CLASSIFIER _X_ BOTH

3. * REASON FOR CALIBRATION
   - ____ REGULARLY SCHEDULED SITE VISIT
   - ____ EQUIPMENT REPLACEMENT
   - ____ DATA TRIGGERED SYSTEM REVISION
   - ____ RESEARCH
   - ____ TRAINING
   - ____ NEW EQUIPMENT INSTALLATION
   - _X__ OTHER (SPECIFY) ___LTPP Validation_____

4. * SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   - ____ BARE ROUND PIEZO CERAMIC
   - ____ BARE FLAT PIEZO
   - _X__ BENDING PLATES
   - ____ CHANNELIZED ROUND PIEZO
   - ____ LOAD CELLS
   - ____ QUARTZ PIEZO
   - ____ CHANNELIZED FLAT PIEZO
   - _X__ INDUCTANCE LOOPS
   - ____ CAPACITANCE PADS
   - ____ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

____ TRAFFIC STREAM -- ____STATIC SCALE (Y/N) _X__ TEST TRUCKS

___ NUMBER OF TRUCKS COMPARED __ 2__ NUMBER OF TEST TRUCKS USED

__ 20__ PASSES PER TRUCK

TYPE PER FHWA 13 BIN SYSTEM
SUSPENSION: 1 - AIR; 2 - LEAF SPRING
3 - OTHER (DESCRIBE)

TRUCK	TYPE	SUSPENSION
1	___9____	___1_____
2	___9____	___2_____
3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)

MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	___-1.5	STANDARD DEVIATION	___3.9
DYNAMIC AND STATIC SINGLE AXLES	___-3.0	STANDARD DEVIATION	___8.7
DYNAMIC AND STATIC DOUBLE AXLES	___-1.2	STANDARD DEVIATION	___5.5

8. 4____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _55_ __60__ __65_ __70_ _____ _____ _____
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___3980___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _N_
IF YES, LIST AND DEFINE AUTO-CALIBRATION VALUE: _____
_____
_____

CLASSIFIER TEST SPECIFICS***

12.*** METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
____ VIDEO _X_ MANUAL ____ PARALLEL CLASSIFIERS

13. METHOD TO DETERMINE LENGTH OF COUNT ____ TIME _X_ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:

*** FHWA CLASS 9	____ -1.2	FHWA CLASS	____	____	____ ____
*** FHWA CLASS 8	____ 0.0	FHWA CLASS	____	____	____ ____
		FHWA CLASS	____	____	____ ____
		FHWA CLASS	____	____	____ ____

*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

SHEET 16 **LTPP MONITORED TRAFFIC DATA** **SITE CALIBRATION SUMMARY**	*STATE ASSIGNED ID [__ __ __ __] *STATE CODE [20] *SHRP SECTION ID [0200]

SITE CALIBRATION INFORMATION

1. * DATE OF CALIBRATION (MONTH/DAY/YEAR) [4/18/2007]

2. * TYPE OF EQUIPMENT CALIBRATED ____ WIM ____ CLASSIFIER _X_ BOTH

3. * REASON FOR CALIBRATION
   - ____ REGULARLY SCHEDULED SITE VISIT
   - ____ EQUIPMENT REPLACEMENT
   - ____ DATA TRIGGERED SYSTEM REVISION
   - ____ RESEARCH
   - ____ TRAINING
   - ____ NEW EQUIPMENT INSTALLATION
   - _X__ OTHER (SPECIFY) ___LTPP Validation_____

4. * SENSORS INSTALLED IN LTPP LANE AT THIS SITE (CHECK ALL THAT APPLY):
   - ____ BARE ROUND PIEZO CERAMIC
   - ____ BARE FLAT PIEZO
   - _X__ BENDING PLATES
   - ____ CHANNELIZED ROUND PIEZO
   - ____ LOAD CELLS
   - ____ QUARTZ PIEZO
   - ____ CHANNELIZED FLAT PIEZO
   - _X__ INDUCTANCE LOOPS
   - ____ CAPACITANCE PADS
   - ____ OTHER (SPECIFY) _____

5. EQUIPMENT MANUFACTURER ___IRD/ PAT Traffic_____

WIM SYSTEM CALIBRATION SPECIFICS**

6.**CALIBRATION TECHNIQUE USED:

_____ TRAFFIC STREAM -- ____STATIC SCALE (Y/N) _X__ TEST TRUCKS

___ NUMBER OF TRUCKS COMPARED __ 2__ NUMBER OF TEST TRUCKS USED

__ 20__ PASSES PER TRUCK

TYPE PER FHWA 13 BIN SYSTEM
SUSPENSION: 1 - AIR; 2 - LEAF SPRING
3 - OTHER (DESCRIBE)

TRUCK	TYPE	SUSPENSION
1	___9____	___1_____
2	___9____	___2_____
3	_____	_____

7. SUMMARY CALIBRATION RESULTS (EXPRESSED AS A PERCENT)

MEAN DIFFERENCE BETWEEN ---

DYNAMIC AND STATIC GVW	___0.5	STANDARD DEVIATION	___3.1
DYNAMIC AND STATIC SINGLE AXLES	___-0.3	STANDARD DEVIATION	___5.3
DYNAMIC AND STATIC DOUBLE AXLES	___0.6	STANDARD DEVIATION	___4.6

8. 4 ____ NUMBER OF SPEEDS AT WHICH CALIBRATION WAS PERFORMED

9. DEFINE THE SPEED RANGES USED (MPH) _____ _55_ __60__ __65_ __70_ _____ _____ _____
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

10. CALIBRATION FACTOR (AT EXPECTED FREE FLOW SPEED) ___4060___

11.** IS AUTO-CALIBRATION USED AT THIS SITE? (Y/N) _N_
IF YES, LIST AND DEFINE AUTO-CALIBRATION VALUE: _____
_____
_____

CLASSIFIER TEST SPECIFICS***

12.*** METHOD FOR COLLECTING INDEPENDENT VOLUME MEASUREMENT BY VEHICLE CLASS:
_____ VIDEO _X_ MANUAL _____ PARALLEL CLASSIFIERS

13. METHOD TO DETERMINE LENGTH OF COUNT ____ TIME _X_ NUMBER OF TRUCKS

14. MEAN DIFFERENCE IN VOLUMES BY VEHICLES CLASSIFICATION:

*** FHWA CLASS 9 ____ 0.0	FHWA CLASS ____	____ ____	____
*** FHWA CLASS 8 ____ 0.0	FHWA CLASS ____	____ ____	____
	FHWA CLASS ____	____ ____	____
	FHWA CLASS ____	____ ____	____

*** PERCENT "UNCLASSIFIED" VEHICLES: ____ 0.0

PERSON LEADING CALIBRATION EFFORT: __Dean J. Wolf, MACTEC_____
CONTACT INFORMATION: _____301-210-5105_____ rev. November 9, 1999

APPENDIX A

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 04-18-07

Rev. 08/31/01

PART I.

1.* FHWA Class 9 2.* Number of Axles 5

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A				D / C
B				D / C
C				D / C
D				D / C
E				D / C
F				D / C

GVW (same units as axles)

7. a) Empty GVW 29,260

*b) Average Pre-Test Loaded weight _____
*c) Post Test Loaded Weight _____
*d) Difference Post Test – Pre-test _____

GEOMETRY

8 a) * Tractor Cab Style - Cab Over Engine / (Conventional) b) * Sleeper Cab? (Y) / N

9. a) * Make: Peterbilt CAT b) * Model: _____

10.* Trailer Load Distribution Description:

_____

_____

_____

_____

11. a) Tractor Tare Weight (units): _____

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 04-18-07

Rev. 08/31/01

12.* Axle Spacing – units m / feet and inches / feet and tenths

A to B 19.6 B to C 4.4 C to D 30.5

D to E 4.1 E to F _____

Wheelbased (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) +0.4 (_____)
(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	Two tapered leaf
B	11R24.5	Air
C	11R24.5	Air
D	11R24.5	Air
E	11R24.5	Air
F	_____	_____

16. Cold Tire Pressures (psi) – from right to left

Steering Axle	Axle B	Axle C	Axle D	Axle E
_____	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
_____	_____	_____	_____	_____

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 04-18-07

Rev. 08/31/01

PART II

Table 1. Axle and GVW computations - pre-test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I		II -I		III -II		IV -III		V -IV		V	
V -VI		VI- VII		VII- VIII		VIII- IX		IX`		X	
										XI	
Avg.											

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I				
A + B	II				
A + B + C	III				
A + B + C + D	IV				
A + B + C + D + E (1)	V				
B + C + D + E	VI				
C + D + E	VII				
D + E	VIII				
E	IX				
A + B + C + D + E (2)	X				
A + B + C + D + E (3)	XI				

Table 3. Axle and GVW computations - post -test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I		II -I		III -II		IV -III		V -IV		V	
V -VI		VI- VII		VII- VIII		VIII- IX		IX`		X	
										XI	
Avg.											

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 1	* DATE 04-17-07

Rev. 08/31/01

Table 4 . Axle and GVW computations -

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I		II -I		III -II		IV -III		V -IV		V	
V -VI		VI-VII		VII-VIII		VIII-IX		IX`		X	
										XI	
Avg.											

Table 5. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	12600	16780	16740	16750	16750		79580
2	12640	16760	16760	16700	16700		79560
3	12460	16780	16780	16770	16770		79560
Average	12570	16760	16760	16740	16740		79570
day 1 post	12260	16710	16710	16750	16750		79180

Table 6. Raw data – Axle scales – day 2 pre

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	12400	16650	16650	16440	16440		78580
2	12120	16780	16780	16470	16470		78620
3	12260	16690	16690	16470	16470		78580
Average	12260	16780	16710	16460	16460		78590
day 2 post	12160	16620	16620	16590	16590		78580

Table 7. Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Measured By _____ Verified By _____

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 04-18-07

Rev. 08/31/01

trailer - 130

PART I.

1.* FHWA Class 9 2.* Number of Axles 5

AXLES - units - lbs / 100s lbs / kg

	3. Empty Truck Axle Weight	4.* Pre-Test Average Loaded Axle Weight	5.* Post-Test Average Loaded Axle Weight	6.* Measured D)irectly or C)alculated?
A				D / C
B				D / C
C				D / C
D				D / C
E				D / C
F				D / C

GVW (same units as axles)

7. a) Empty GVW 28220

*b) Average Pre-Test Loaded weight _____
*c) Post Test Loaded Weight _____
*d) Difference Post Test – Pre-test _____

GEOMETRY

8 a) * Tractor Cab Style - Cab Over Engine / (Conventional) b) * Sleeper Cab? (Y) / N

9. a) * Make: Kenworth b) * Model: _____

10.* Trailer Load Distribution Description:

_____

_____

_____

_____

11. a) Tractor Tare Weight (units): _____

b). Trailer Tare Weight (units): _____

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 04-19-07

Rev. 08/31/01

12.* Axle Spacing – units m / feet and inches / feet and tenths

A to B 20.0 B to C 4.4 C to D 31.4

D to E 4.1 E to F _____

Wheelbased (measured A to last) _____ Computed _____

13. *Kingpin Offset From Axle B (units) +1.4 (_____)

(+ is to the rear)

SUSPENSION

Axle	14. Tire Size	15.* Suspension Description (leaf, air, no. of leaves, taper or flat leaf, etc.)
A	11R24.5	Air 3 tapered leaves.
B	11R24.5	Air
C	11R24.5	Air
D	275R24.5	3 tapered leaves
E	285/75R24.5	3 tapered leaves
F	_____	_____

16. Cold Tire Pressures (psi) – from right to left

Steering Axle	Axle B	Axle C	Axle D	Axle E
_____	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
_____	_____	_____	_____	_____

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 04-18-07

Rev. 08/31/01

PART II

Table 1. Axle and GVW computations - pre-test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I		II -I		III -II		IV -III		V -IV		V	
V -VI		VI- VII		VII- VIII		VIII- IX		IX`		X	
										XI	
Avg.											

Table 2. Raw Axle and GVW measurements

Axles	Meas.	Pre-test Weight			Post-test Weight
A	I				
A + B	II				
A + B + C	III				
A + B + C + D	IV				
A + B + C + D + E (1)	V				
B + C + D + E	VI				
C + D + E	VII				
D + E	VIII				
E	IX				
A + B + C + D + E (2)	X				
A + B + C + D + E (3)	XI				

Table 3. Axle and GVW computations - post -test

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I		II -I		III -II		IV -III		V -IV		V	
V -VI		VI- VII		VII- VIII		VIII- IX		IX`		X	
										XI	
Avg.											

Sheet 19	* STATE_CODE 20
LTPP Traffic Data	* SPS PROJECT ID 0200
*CALIBRATION TEST TRUCK # 2	* DATE 04-19-07

Rev. 08/31/01

Table 4 . Axle and GVW computations -

Axle A		Axle B		Axle C		Axle D		Axle E		GVW	
I		II -I		III -II		IV -III		V -IV		V	
V -VI		VI- VII		VII- VIII		VIII- IX		IX`		X	
										XI	
Avg.											

Table 5. Raw data – Axle scales – pre-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	10660	14870	14870	13380	13380		67960
2	10740	14790	14790	13290	13290		66900
3	10820	14740	14740	13390	13390		67080
Average	10740	14800	14800	13350	13350		67080
day 1 post	10520	14780	14780	13210	13210		66500

Table 6. Raw data – Axle scales –

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1	11100 ~~12120~~	14870 ~~16780~~	14870 ~~16780~~	12970 ~~16470~~	12970 ~~16470~~		66780
2	10860	14900	14900	12910	12910		66480
3	11040	14910	14910	12960	12960		66780
Average	11000	14890	14890	12950	12950		66680
day 2 post	10700	14910	14910	12910	12910		64340

Table 7. Raw data – Axle scales – post-test

Pass	Axle A	Axle B	Axle C	Axle D	Axle E	Axle F	GVW
1							
2							
3							
Average							

Measured By _____ Verified By _____

Sheet 20	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 1 of* 2	* DATE 04/17/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
68	9	23952	70	9	67	9	24250	67	9
67	5	23956	68	5	64	9	24286	65	9
64	9	23963	65	9	67	12	24310	68	12
64	9	23965	65	9	66	9	24312	68	9
68	8	24013	69	8	64	11	24340	65 70	9 11
62	9	24018	63	9	64	11	24389	65	11
70	5	24019	71	5	68	5	24390	68	5
65	9	24023	65	9	67	9	24408	68	9
64	9	24047	65	9	64	9	24411	65	9
69	5	24067	70	5	72	9	24420	73	9
67	9	24072	69	9	65	9	24425	65	9
66	9	24075	66	9	63	9	24427	64	9
71	9	24094	72	9	59	9	24430	60	9
72	9	24099	73	9	69	9	24468	65	9
67	9	24101	68	9	70	9	24469	71	9
68	9	24106	69	9	73	9	24476	73	9
63	11	24116	65	11	68	9	24477	70	9
64	9	24124	64	9	64	9	24480	66	9
54	9	24132	54	9	70	9	24491	70	9
55	11	24135	55	9	61	11	24495	62	11
69	9	24171	69	9	68	9	24505	70	9
67	9	24179	68	9	72	9	24510	71	9
67	5	24189	69	5	72	9	24545	73	9
64	11	24197	65	11	66	9	24552	67	9
65	9	24203	64	9	70	9	24555	70	9

Recorded by Aubrie Direction W Lane 1 Time from 9:50 to 11:43

Sheet 20	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 2 of*2	* DATE 04/17/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
62	9	24563	63	9	70	9	25350	71	9
69	9	24566	70	9	72	9	25359	73	9
70	9	24568	71	9	61 68	911	25496	63 68	911
67	9	24569	68	9	67	9	25503	69	9
68	9	24570	69	9	70	9	25507	70	9
64	9	24571	64	9	63	9	25513	64	9
67	9	24582	67	9	70	9	25515	71	9
58	9	24583	59	9	68	9	25517	68	9
67	9	25027	67	9	69	9	25523	69	9
68	9	25029	68	9	73	9	25528	73	9
72	9	25031	73	9	72	9	25531	73	9
68	9	25034	69	9	63	9	25533	64	9
70	9	25037	69	9	64	9	25537	63	9
60	5	25043	59	5	68	9	25553	68	9
63	9	25050	62	9	62	9	25559	63	9
70	9	25058	70	9	74	9	25565	74	9
64	9	25059	65	9	73	9	25572	73	9
66	9	25066	68	9	69	9	25573	70	9
73	9	25070	73	9	70	9	25576	71	9
62	9	25072	64	9	68	9	25583	69	9
69	9	25321	70	9	68	8	25590	67	8
64	9	25326	65	9	68	9	25596	68	9
65	9	25327	66	9	64	9	25598	64	9
66	9	25342	67	9	67	9	25601	68	9
67	9	25347	67	9	63	5	25604	64	5

Recorded by [signature] Direction WB Lane 1 Time from 11:45 to 2:45

Sheet 20	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
Speed and Classification Checks * 1 of* 2	* DATE 04/18/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
70	6	29928	70	6	65	9	30132	65	9
64	9	29930	64	9	70	9	30188	70	9
64	9	29932	64	9	69	9	30195	70	9
64	9	29942	64	9	66	9	30202	66	9
70	9	29945	70	9	62	8	30206	62	8
62	10	29947	61	10	70	12	30208	69	12
64	11	29954	64	11	72	9	30216	72	9
60	9	29958	60	9	67	8	30217	68	8
60	9	29963	60	9	68	5	30221	68	5
75	~~7~~ 8	29991	76	8	74	9	30259	74	9
70	5	29997	70	5	71	9	30264	71	9
74	9	30002	73	9	78	9	30270	79	9
65	11	30037	66	11	62	9	30275	63	9
70	9	30085	70	9	69	9	30282	69	9
70	9	30088	70	9	72	9	30290	72	9
73	5	30090	73	5	70	9	30292	71	9
74	9	30098	74	9	62	11	30296	63	11
74	9	30099	74	9	64	9	30297	64	9
65	11	30102	65	11	67	9	30299	67	9
69	5	30104	70	5	64	5	30303	66	5
70	9	30108	70	9	65	9	30306	66	9
70	9	30109	70	9	62	9	30311	61	9
61	11	30111	60	11	60	9	30315	60	9
70	9	30116	70	9	69	9	30342	70	9
67	9	30124	68	9	68	9	30347	69	9

Recorded by [signature] Direction W Lane 1 Time from 10:31 to 11:48

Sheet 20	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
Speed and Classification Checks * 2 of* 2	* DATE	04/18/2007

Rev. 08/31/2001....

WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class	WIM speed	WIM class	WIM Record	Obs. Speed	Obs Class
67	9	30595	67	9	67	9	30816	68	9
68	9	30605	69	9	69	9	30896	70	9
72	9	306009	72	9	67	6	30914	68	6
69	9	30625	70	9	68	9	30919	68	9
73	9	30630	73	9	64	9	30954	65	9
64	9	30637	64	9	68	8	30958	68	8
70	9	30644	70	9	65	8	30968	66	8
72	9	30646	72	9	67	9	30981	68	9
64	11	30647	65	11	69	9	30990	70	9
68	9	30650	68	9	71	9	30991	70	9
73	9	30654	73	9	64	9	30992	64	9
70	9	30727	70	9	68	9	31001	68	9
67	9	30731	66	9	70	9	31002	71	9
69	9	30733	68	9	59	9	31008	60	9
72	12	30735	73	12	69	9	31012	69	9
63	11	30783	63	9 11	70	9	31040	70	9
77	9	30784	77	9	67	9	31051	67	9
61	9	30789	60	9	71	9	31052	72	9
60	9	30791	61	9	64	9	31059	65	9
73	9	30796	73	9	72	9	31070	73	9
63	9	30798	62	9	63	9	31073	63	9
73	6	30803	73	6	68	9	31074	67	9
70	9	30807	70	9	72	9	31079	72	9
68	9	30809	68	9	72	9	31080	72	9
69	9	30815	69	9	70	9	31082	69	9

Recorded by [signature] Direction W Lane 1 Time from 12:30 to 2:15

Sheet 21	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 1 of 3	* DATE 04/17/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space	
58.5	53	1	1	9:40:10	23918	52	6.1 / 6.3	8.6 / 8.6	8.5 / 8.4	7.1 / 9.1	7.8 / 8.4		78.7	19.2	4.3	30.1	4.0		✓
52.5	54	2	1	9:40:30	23920	54	5.5 / 5.4	8.2 / 7.5	7.2 / 7.3	4.2 / 6.4	7.4 / 8.1	1.2 / 1.2	69.6	19.6	4.3	31.1	3.9	1.8	✓
59.0	65	1	2	9:52:53	23963	64	7.1 / 6.4	9.5 / 8.1	9.4 / 7.7	7.8 / 8.3	8.5 / 7.6		80.5	19.3	4.3	30.1	4.0		✓
89.0	65	2	2	9:53:37	23965	64	5.1 / 5.9	7.4 / 7.9	7.3 / 8.2	4.1 / 6.6	7.6 / 8.8		68.9	19.7	4.2	31.0	3.9		✓
54.5	71	1	3	10:09:18	24048	71	6.6 / 5.9	8.7 / 8.1	9.0 / 8.3	7.6 / 8.4	8.4 / 7.2		78.3	19.2	4.3	30.1	4.0		✓
54.5	73	2	3	10:09:38	24052	73	4.2 / 4.0	5.3 / 7.8	7.3 / 6.2	6.9 / 5.1	5.7 / 8.1		61.2	19.7	4.2	31.0	3.9		✓
57.0	54	1	4	10:25:15	24132	54	6.5 / 5.4	8.7 / 7.7	8.7 / 7.8	7.5 / 9.1	7.9 / 8.3		77.6	19.3	4.3	30.1	4.0		✓
57.0	55	2	4	10:26:02	24135	55	5.8 / 5.4	7.6 / 7.7	7.4 / 7.2	4.5 / 6.3	7.0 / 8.1	0.8 / 0.8	68.6	19.7	4.3	31.2	4.0	1.9	✓
59.0	63	1	5	10:40:08	24207	62	7.2 / 6.3	9.4 / 7.6	9.0 / 7.4	7.6 / 8.2	9.2 / 8.3		80.0	19.2	4.3	30.1	4.0		✓
59.0	64	2	5	10:40:36	24211	64	3.8 / 5.6	6.4 / 8.1	6.8 / 7.8	5.4 / 6.0	7.5 / 8.3		65.9	19.7	4.3	31.0	3.9		✓
66.0	71	1	6	10:54:24	24289	71	6.9 / 6.3	8.8 / 8.3	8.8 / 8.2	8.0 / 8.3	8.7 / 7.0		79.3	19.3	4.3	30.1	4.0		✓
~~66.2~~	~~75~~	~~2~~	~~6~~	~~10:54:40~~	~~24293~~	~~73~~	4.5 / 3.4	5.2 / 7.0	2.9 / 7.5	7.3 / 5.9	5.7 / 8.8		50.5	19.7	4.8	31.1	3.9		✓
62.5	55	1	7	11:08:25	24360	54	6.1 / 6.5	8.8 / 8.3	8.5 / 8.1	7.7 / 8.7	8.5 / 8.4		79.5	19.2	4.3	30.0	4.0		✓
62.5	55	2	7	11:09:13	24362	55	5.8 / 5.3	8.1 / 7.3	8.4 / 7.0	8.5 / 6.1	7.4 / 7.7		69.0	19.8	4.5	31.0	3.9		✓
63.0	60	1	8	11:21:49	24430	59	6.5 / 5.3	7.9 / 7.3	7.8 / 7.5	3.2 / 9.2	8.1 / 10.0		73.0	19.1	4.2	30.4	3.9		✓
63.0	60	2	8	11:23:10	24436	59	5.2 / 4.9	6.9 / 6.9	7.3 / 6.3	5.7 / 6.1	6.7 / 9.5		65.7	19.7	4.3	30.9	3.9		✓

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 2 of 3	* DATE	04/17/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
69.5	69	1	9	11:38:42	24527	67	6.0 / 6.4	9.2 / 8.9	8.6 / 8.7	7.5 / 10.3	8.3 / 9.4		82.7	19.2	4.2	30.0	4.0	
69.5	70	2	9	11:39:24	24530	69	4.1 / 5.5	5.4 / 8.4	6.0 / 8.1	3.7 / 5.2	6.6 / 8.3		61.2	19.7	4.3	31.0	3.9	
69.5	73	1	10	11:52:00	24588	72	6.7 / 5.1	8.3 / 7.1	7.8 / 7.4	7.3 / 9.0	9.1 / 9.0		76.8	19.2	4.3	30.6	3.9	
70.5	54	2	10	13:36:24	25183	54	5.6 / 5.8	7.9 / 7.7	7.7 / 7.4	4.9 / 7.1	6.8 / 8.2		68.7	19.7	4.1	31.0	3.8	
70.5	62	1	11	13:49:54	25273	62	6.5 / 5.0	9.1 / 8.7	7.9 / 9.0	5.9 / 10.2	8.4 / 9.4		79.8	19.2	4.3	30.1	4.0	
70.5	63	2	11	13:50:14	25274	63	4.3 / 5.4	6.7 / 7.9	5.3 / 7.7	4.4 / 5.0	4.8 / 8.2		59.6	19.7	4.3	31.0	3.9	
70.0	57	1	12	14:05:26	25364	57	6.2 / 5.6	8.6 / 8.2	8.3 / 7.9	7.3 / 8.7	9.4 / 7.6		77.7	19.2	4.3	30.0	4.0	
70.0	72	2	12	14:05:48	25366	72	4.6 / 4.2	6.3 / 7.0	6.8 / 6.7	6.0 / 6.1	6.8 / 7.7		62.3	19.6	4.2	30.9	3.9	
69.5	52	1	13	14:18:42	25440	53	6.4 / 6.1	8.7 / 8.2	8.8 / 8.2	7.3 / 8.9	8.0 / 8.0		78.7	19.2	4.3	30.1	4.0	
69.5	53	2	13	14:19:09	25445	53	5.9 / 5.8	8.2 / 7.9	7.2 / 7.2	5.9 / 6.7	7.0 / 8.1		69.9	19.7	4.1	31.2	4.0	
69.5	64	1	14	14:33:22	25533	63	6.4 / 6.4	9.3 / 7.9	7.1 / 8.5	7.7 / 7.1	8.7 / 5.5		74.7	19.2	4.3	30.1	4.0	
69.5	63	2	14	14:33:54	25537	64	4.1 / 6.1	5.8 / 8.2	7.3 / 7.8	5.5 / 6.2	7.2 / 9.2		67.3	19.7	4.2	31.0	3.9	
69.5	54	1	15	15:06:13	25721	54	6.4 / 6.1	6.1 / 8.0	8.3 / 7.8	7.7 / 9.1	8.6 / 8.7		76.7	19.5	4.2	30.5	3.9	
70.0	~~63~~	2	15	14:59:25	25627	~~63~~	3.9 / 4.3	4.5 / 7.1	6.4 / 7.5	8.1 / 7.0	6.3 / 9.0		64.1	19.7	4.3	31.1	3.9	
69.5	54	2	16	15:06:47	25725	54	5.9 / 5.3	8.3 / 7.8	7.3 / 7.1	4.9 / 6.9	7.3 / 7.9		68.8	19.7	4.2	30.5	3.8	

Recorded by _____ Checked by _____

Rec. No - 25615 - 25620

Sheet 21	* STATE_CODE 20
LTPP Traffic Data	*SPS PROJECT_ID 0200
WIM System Test Truck Records 3 of 3	* DATE 04/17/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
69.5	64	1	16	15:21:33	25807	64	4.7 / 6.0	6.7 / 7.6	8.7 / 7.9	7.9 / 7.1	9.1 / 5.8		71.4	19.3	4.3	30.1	4.0	
69.5	64	2	17	15:22:17	25812	64	4.0 / 5.7	6.3 / 8.0	7.1 / 7.9	5.9 / 6.1	7.5 / 8.3		69.8	19.7	4.2	31.0	3.9	
72.0	70	1	17	15:40:59	25930	70	6.0 / 6.3	9.0 / 8.4	8.0 / 8.8	7.1 / 10.3	7.9 / 9.4		81.2	19.2	4.3	30.0	4.0	
72.0	73	2	18	15:40:55	25933	73	4.4 / 4.1	4.8 / 7.0	7.0 / 6.8	7.8 / 6.2	6.0 / 8.2		62.4	19.7	4.2	31.0	3.9	
70.5	54	1	18	15:58:29	26023	54	6.3 / 5.9	8.7 / 8.3	8.6 / 8.2	7.6 / 8.8	8.0 / 8.3		78.2	19.2	4.3	30.1	4.0	
70.5	54	2	19	15:58:34	26031	54	5.6 / 5.2	7.7 / 7.5	8.2 / 7.0	5.9 / 6.2	8.2 / 8.0		67.4	19.8	4.4	31.3	3.9	
68.5	62	1	19	16:22:15	26250	62	6.5 / 6.7	9.4 / 7.9	8.2 / 6.6	7.7 / 7.3	8.7 / 10.0		79.1	19.2	4.3	30.1	4.0	
68.5	64	2	20	16:22:38	26253	64	4.8 / 5.9	6.6 / 8.3	7.4 / 7.8	5.8 / 5.6	7.7 / 8.5		67.9	19.6	4.2	30.9	3.9	
70.5	55	1	20	13:35:22	25173	55	6.3 / 6.3	8.1 / 8.6	7.8 / 8.5	8.6 / 7.9	8.2 / 8.7		79.0	19.3	4.3	30.1	4.0	
70.0	72	1	21	14:49:04	25626	72	6.3 / 5.7	8.5 / 7.1	9.0 / 8.7	9.8 / 6.0	8.9 / 7.7		77.6	19.2	4.3	29.9	4.0	

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 3	* DATE	04/18/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
52.0	55	1	1	9:20:52	29553	55	6.3 / 5.5	9.8 / 8.1	8.3 / 8.3	8.4 / 9.2	9.1 / 8.0		81.5	19.5	4.2	30.4	4.1	
52.0	55	2	1	9:21:17	29557	55	5.6 / 5.3	8.1 / 7.3	7.9 / 6.9	6.0 / 5.7	7.3 / 7.6		67.6	20.0	4.2	31.4	3.8	
53.5	60	1	2	9:36:55	29633	60	5.8 / 5.8	8.6 / 7.6	8.8 / 7.8	9.7 / 7.9	10.0 / 6.6		76.4	19.5	4.3	30.4	4.0	
53.5	60	2	2	9:37:31	29637	60	5.6 / 5.2	7.0 / 6.8	9.6 / 6.6	5.5 / 6.6	6.9 / 6.9		64.7	20.0	4.3	31.5	4.0	
56	65	1	3	9:52:54	29716	65	6.8 / 5.8	9.7 / 7.5	9.4 / 7.6	8.0 / 6.4	9.3 / 8.4		78.9	19.5	4.3	30.4	4.0	
56	64	2	3	9:53:27	29719	64	4.8 / 6.2	5.9 / 8.1	7.0 / 8.3	5.1 / 6.2	7.4 / 9.0		68.2	19.9	4.3	31.5	4.0	
63.0	69	1	4	10:05:57	29794	68	6.4 / 6.2	9.1 / 8.2	9.0 / 8.5	8.1 / 9.8	9.0 / 9.4		83.4	19.4	4.3	30.3	4.0	
63.0	68	2	4	10:06:14	29804	68	4.2 / 5.7	7.3 / 8.2	8.2 / 8.0	3.9 / 6.1	7.6 / 7.3		66.6	19.9	4.3	31.4	3.9	
65.0	55	1	5	10:22:12	29878	55	6.6 / 5.4	9.9 / 7.9	9.1 / 7.8	8.2 / 8.4	8.10 / 7.7		78.6	19.5	4.4	30.5	4.0	
65.0	54	2	5	10:22:41	29881	54	6.0 / 5.6	8.4 / 7.6	7.8 / 7.4	5.6 / 6.1	7.2 / 7.6		69.1	19.9	4.2	31.4	3.8	

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 3	* DATE	04/18/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
52.0	55	1	1	9:20:52	29553	55	6.3 / 5.5	9.8 / 8.1	8.3 / 8.3	8.4 / 9.2	9.1 / 8.0		81.5	19.5	4.2	30.4	4.1	
52.0	55	2	1	9:21:17	29557	55	5.6 / 5.3	8.1 / 7.3	7.9 / 6.9	6.0 / 5.7	7.3 / 7.6		67.6	20.0	4.2	31.4	3.8	
53.5	60	1	2	9:36:55	29633	60	5.8 / 5.8	8.6 / 7.6	8.8 / 7.8	7.7 / 7.9	10.0 / 6.6		76.4	19.5	4.3	30.4	4.0	
53.5	60	2	2	9:37:31	29637	60	5.6 / 5.2	9.0 / 6.8	9.6 / 6.6	5.5 / 6.6	6.9 / 6.9		64.7	20.0	4.3	31.5	4.0	
56	68	1	3	9:52:54	29714	65	6.8 / 5.8	9.7 / 7.5	9.4 / 7.6	8.0 / 6.4	9.3 / 8.4		78.9	19.5	4.3	30.4	4.0	
56	64	2	3	9:53:27	29719	64	4.8 / 6.2	5.9 / 8.1	7.0 / 8.3	5.1 / 6.2	7.4 / 9.0		68.2	19.9	4.3	31.7	4.0	
63.0	69	1	4	10:05:31	29794	68	6.4 / 6.2	9.1 / 8.2	9.0 / 8.5	8.1 / 9.8	9.0 / 9.4		83.4	19.4	4.3	30.3	4.0	
63.0	68	2	4	10:06:**	29804	68	4.2 / 5.7	7.3 / 8.2	8.2 / 8.0	3.9 / 6.1	7.6 / 7.3		66.6	19.9	4.3	31.4	3.9	
65.0	55	1	5	10:22:12	29878	55	6.6 / 5.4	9.0 / 7.9	9.1 / 7.8	8.2 / 8.4	8.6 / 7.7		78.6	19.5	4.4	30.5	4.0	
65.0	54	2	5	10:22:41	29881	54	6.0 / 5.6	8.4 / 7.6	7.8 / 7.4	5.6 / 6.1	7.2 / 7.6		69.1	19.9	4.2	31.4	3.8	

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 1 of 3	* DATE	04/18/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
73.5	60	1	6	10:37:35	29958	60	6.1 / 5.3	9.7 / 7.3	9.3 / 7.9	7.4 / 7.8	10.0 / 7.5		78.2	19.5	4.3	30.5	4.0	
73.5	60	2	6	10:38:13	29963	60	5.2 / 5.0	7.4 / 6.8	7.8 / 6.8	4.9 / 6.3	7.5 / 9.4		66.6	19.9	4.3	31.5	4.1	
72.5	64	1	7	10:50:55	30039	64	5.1 / 5.8	9.8 / 7.3	9.5 / 7.3	8.6 / 8.7	9.9 / 5.8		79.9	19.5	4.3	30.3	4.3	
72.5	64	2	7	10:51:42	30045	64	4.2 / 5.7	6.8 / 8.1	6.1 / 7.8	4.4 / 5.1	6.0 / 8.3		63.1	19.9	4.3	31.4	4.0	
74.0	70	1	8	11:08:44	30141	69	6.8 / 5.7	9.8 / 7.2	9.5 / 7.4	8.5 / 8.6	10.1 / 8.8		82.4	19.5	4.3	30.4	4.3	
74.0	70	2	8	11:09:30	30144	70	5.0 / 5.5	6.6 / 7.5	7.4 / 8.2	5.6 / 6.3	6.1 / 8.1		67.2	19.9	4.3	31.4	3.9	
76.5	54	1	9	11:24:07	30222	55	6.3 / 6.2	9.1 / 7.8	8.1 / 7.8	5.7 / 6.9	9.3 / 8.5		77.4	19.5	4.3	30.8	4.0	
76.5	55	2	9	11:24:58	30226	55	5.5 / 5.6	8.6 / 7.2	4.2 / 7.4	4.7 / 5.6	9.2 / 7.5		63.5	19.9	4.5	31.7	4.0	
79.5	61	1	10	11:40:01	30311	62	7.0 / 5.4	7.8 / 7.0	7.8 / 7.2	7.4 / 8.0	8.9 / 9.2		75.5	19.4	4.3	30.4	4.3	
79.5	60	2	10	11:40:21	30315	60	4.7 / 5.4	6.8 / 8.1	7.2 / 8.0	5.4 / 6.1	6.3 / 9.0		66.9	19.9	4.4	31.6	4.0	
85.0	64	1	11	12:46:27	30663	64	4.8 / 6.3	9.7 / 7.9	9.2 / 8.0	8.4 / 9.2	9.8 / 9.2		82.5	19.4	4.3	30.4	4.3	
85.0	64	2	11	12:46:55	30667	64	4.8 / 6.1	7.3 / 8.4	7.9 / 8.1	4.5 / 6.4	7.6 / 8.6		68.8	20.0	4.3	31.5	4.3	
89.0	70	1	12	12:59:18	30136	70	5.3 / 5.8	9.8 / 7.9	9.1 / 8.0	8.3 / 8.8	9.4 / 8.6		79.0	19.5	4.3	30.5	4.0	
89.0	70	2	12	13:00:40	30141	70	4.8 / 6.2	6.5 / 8.7	6.1 / 8.2	4.3 / 4.9	6.9 / 8.1		64.4	19.9	4.3	31.4	4.0	
89.0	54	1	13	13:15:22	30823	55	6.3 / 6.0	8.8 / 7.6	5.4 / 7.9	6.3 / 8.8	9.4 / 8.5		95.1	19.4	4.3	30.9	4.0	
89.0	55	2	13	13:16:11	30829	55	5.5 / 5.4	8.3 / 7.1	7.4 / 7.4	5.5 / 6.4	6.6 / 7.7		66.9	20.0	4.4	31.1	4.0	

Recorded by _____ Checked by _____

Sheet 21	* STATE_CODE	20
LTPP Traffic Data	*SPS PROJECT_ID	0200
WIM System Test Truck Records 3 of 3	* DATE	04/18/2007

Rev. 08/31/2001

Pvmt temp	Radar Speed	Truck	Pass	Time	Record No.	WIM Speed	Axle A weight.	Axle B weight.	Axle C weight.	Axle D weight.	Axle E weight.	Axle F weight	GVW	A-B space	B-C space	C-D space	D-E space	E-F space
91.0	65	1	14	13:31:23	30923	65	7.4 / 6.1	9.9 / 7.8	8.7 / 7.8	8.7 / 9.0	9.4 / 8.7		80.5	19.5	4.3	30.4	4.0	
91.0	65	2	14	13:32:07	30929	65	4.8 / 6.2	7.2 / 8.3	5.8 / 8.0	4.5 / 5.9	7.2 / 8.3		66.2	19.9	4.3	31.4	4.0	
91.0	60	1	15	13:46:58	31008	59	5.4 / 5.6	8.2 / 8.0	8.1 / 8.6	7.5 / 8.6	8.3 / 8.4		76.9	19.5	4.4	30.5	4.0	
91.0	69	2	15	13:46:27	31012	69	5.2 / 6.1	7.2 / 7.7	8.3 / 8.1	5.2 / 5.6	7.4 / 7.8		68.5	19.9	4.3	31.4	4.3	
91.5	69	1	16	13:58:15	31082	70	7.1 / 6.1	9.5 / 7.9	9.1 / 8.0	8.6 / 8.5	4.9 / 8.3		77.8	19.5	4.3	30.5	4.3	
91.5	55	2	16	13:59:47	31090	55	5.7 / 5.4	7.7 / 7.5	7.4 / 7.4	5.7 / 6.2	6.2 / 7.9		67.2	19.9	4.4	31.1	4.0	
94.0	55	1	17	14:11:35	31148	55	6.2 / 5.8	8.1 / 7.9	8.0 / 7.8	7.7 / 9.2	8.7 / 8.5		78.6	19.4	4.3	30.3	4.0	
94.0	64	2	17	14:13:39	31170	64	4.3 / 6.1	7.2 / 8.5	7.8 / 8.1	5.4 / 5.7	7.2 / 8.7		68.9	19.9	4.3	31.5	3.9	
82.5	55	1	18	14:29:37	31273	55	6.3 / 6.5	8.6 / 8.0	8.2 / 8.1	8.0 / 8.5	8.7 / 8.2		79.0	19.6	4.4	30.6	4.1	
82.5	70	2	18	14:32:54	31288	70	4.2 / 5.8	6.3 / 8.4	7.0 / 8.2	4.4 / 5.9	6.8 / 7.5		64.5	19.9	4.3	31.4	4.0	
83.5	70	1	19	14:43:30	31350	70	6.4 / 6.4	9.6 / 8.1	8.9 / 8.1	8.2 / 9.6	8.9 / 8.8		82.9	19.4	4.3	30.5	4.0	
83.5	70	2	19	14:45:40	31365	70	5.3 / 6.0	6.7 / 8.0	5.8 / 8.0	5.1 / 5.1	7.1 / 7.4		61.7	19.9	4.3	31.4	4.0	
86.0	54	1	20	14:55:20	31425	54	6.4 / 5.9	8.7 / 7.8	6.2 / 8.0	6.4 / 8.7	8.8 / 8.4		75.2	19.4	4.5	31.0	4.2	
86.0	54	2	20	14:59:29	31457	54	6.2 / 5.5	8.1 / 7.4	7.9 / 7.0	5.6 / 7.0	6.9 / 7.6		69.1	20.0	4.3	31.5	4.0	
86.5	70	1	21	15:08:48	31517	71	6.9 / 5.9	9.8 / 7.5	9.5 / 7.8	8.5 / 8.7	9.7 / 9.0		83.2	19.5	4.3	30.4	4.0	
86.5	70	2	21	15:12:30	31542	70	3.9 / 5.6	6.2 / 8.4	7.3 / 8.2	4.5 / 6.2	6.5 / 7.8		64.3	19.9	4.3	31.4	4.0	

Recorded by _____ Checked by _____

3.11.2. Iteration 1 Worksheet

Date 4/17/07

Beginning factors:

Speed Point (mph)	Name	Value
~~Overall~~ spacing	axle sensor spacing	365 cm
Front Axle		1 / 2
1 – (88)	speed bin 1	3784 / 3784
2 – (96)	2	3901 / 3901
3 – (105)	3	3943 / 3943
4 – (112)	4	3980 / 3980
5 – (120)	5	3922 / 3922

Errors (Pre-Validation):

	Speed Point 1 (55)	Speed Point 2 (60)	Speed Point 3 (65)	Speed Point 4 (70)	Speed Point 5 (75)
F/A	0	-5%	-3%	5%	-12%
Tandem	0	-3%	-3%	-2%	-2%
GVW	0	-5%	-5%	3%	-5%

Adjustments:

	Raise	Lower	Percentage
~~Overall~~ spacing	☑	☐	12%
Front Axle	☐	☐	
Speed Point 1	☐	☐	
Speed Point 2	☑	☐	2%
Speed Point 3	☑	☐	2%
Speed Point 4	☑	☐	2%
Speed Point 5	☑	☐	5%

End factors:

Speed Point (mph)	Name	Value
~~Overall~~ spacing	axle sensor spacing	370 cm
Front Axle		
1 – (88)	speed bin 1	3784
2 – (96)	2	3979
3 – (105)	3	4022
4 – (112)	4	4060
5 – (120)	5	4118

TEST VEHICLE PHOTOGRAPHS FOR SPS WIM VALIDATION

April 17 and 18, 2007

STATE: Kanasas

SHRP ID: 0200

Photo 1 - Truck_1_Tractor_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

Photo 2 - Truck_1_Trailer__6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

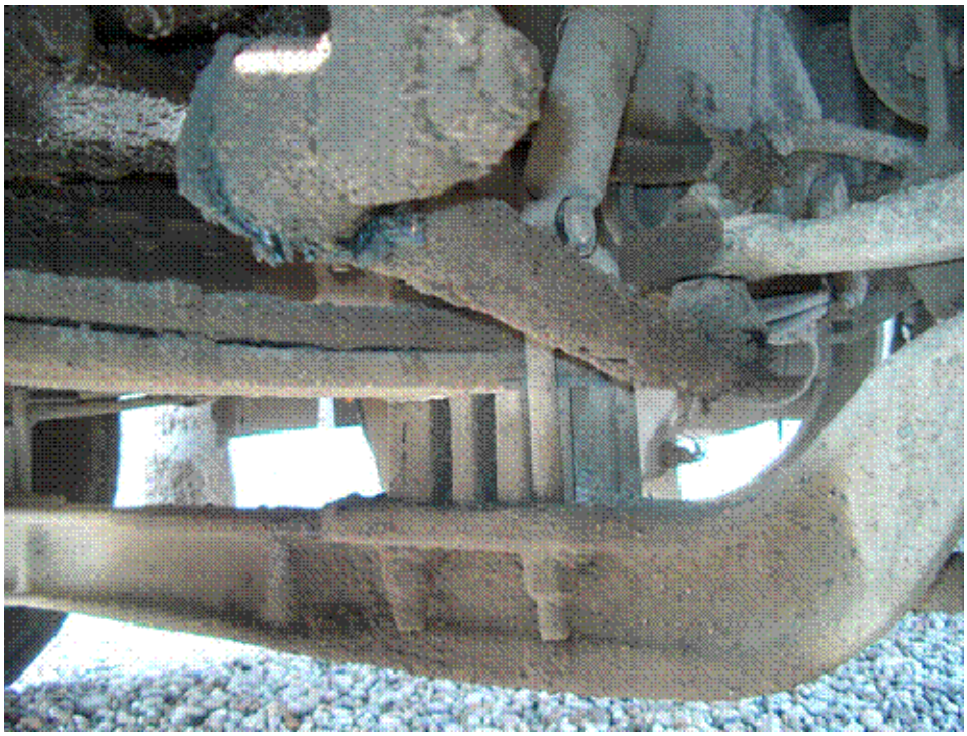


Photo 3 - Truck_1_Suspension_1_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

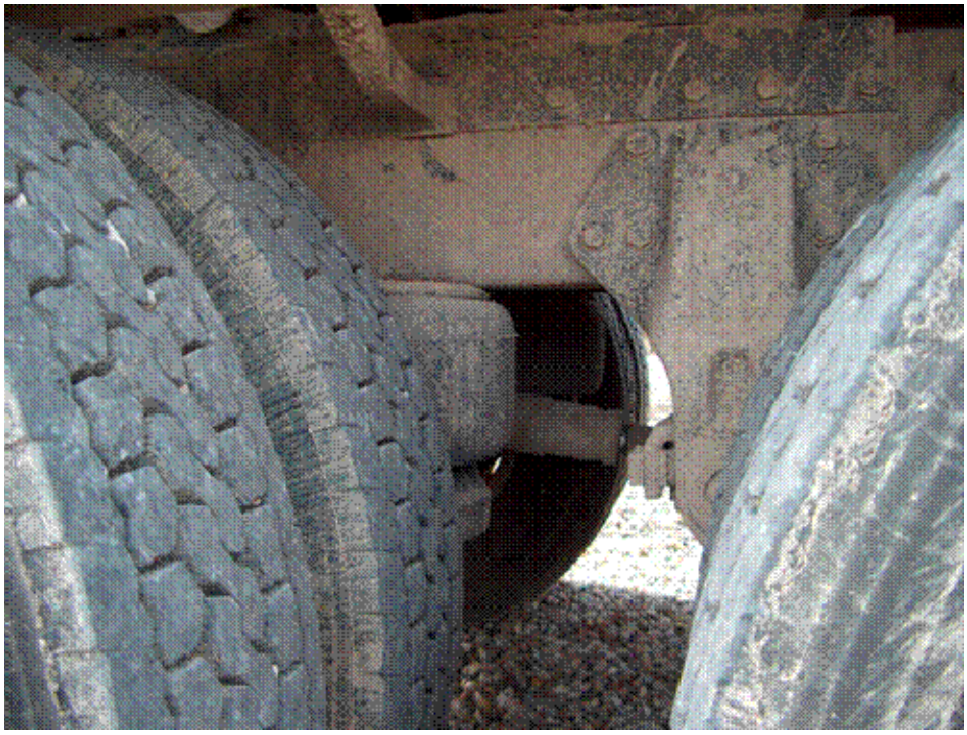


Photo 4 - Truck_1_Suspension_2_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

Photo 5 - Truck_1_Suspension_3_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

Photo 6 - Truck_2_Tractor_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

Photo 7 - Truck_2_Trailer_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

Photo 8 - Truck_2_Suspension_1_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

Photo 9 - Truck_2_Suspension_2_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

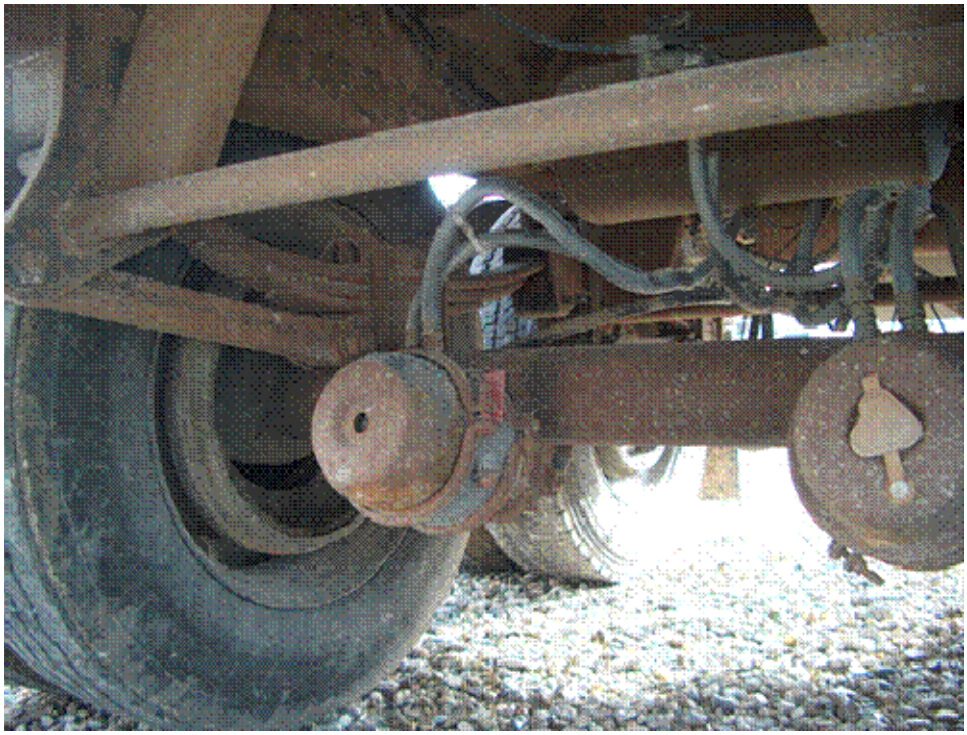


Photo 10 - Truck_2_Suspension_3_6420060018_SPSWIM_TO_18_20_2.86_0200_04_17_07.JPG

ETG LTPP CLASS SCHEME, MOD 3

Class	Vehicle Type	No. Axles	Spacing 1	Spacing 2	Spacing 3	Spacing 4	Spacing 5	Spacing 6	Spacing 7	Spacing 8	Gross Weight Min-Max	Axle 1 Weight Min *
1	Motorcycle	2	1.00-5.99								0.10-3.00	
2	Passenger Car	2	6.00-10.10								1.00-7.99	
3	Other (Pickup/Van)	2	10.11-23.09								1.00-7.99	
4	Bus	2	23.10-40.00								12.00 >	
5	2D Single Unit	2	6.00-23.09								8.00 >	2.5
2	Car w/ 1 Axle Trailer	3	6.00-10.10	6.00-25.00							1.00-11.99	
3	Other w/ 1 Axle Trailer	3	10.11-23.09	6.00-25.00							1.00-11.99	
4	Bus	3	23.10-40.00	3.00-7.00							20.00 >	
5	2D w/ 1 Axle Trailer	3	6.00-23.09	6.30-30.00							12.00-19.99	2.5
6	3 Axle Single Unit	3	6.00-23.09	2.50-6.29							12.00 >	3.5
8	Semi, 2S1	3	6.00-23.09	11.00-45.00							20.00 >	3.5
2	Car w/ 2 Axle Trailer	4	6.00-10.10	6.00-30.00	1.00-11.99						1.00-11.99	
3	Other w/ 2 Axle Trailer	4	10.11-23.09	6.00-30.00	1.00-11.99						1.00-11.99	
5	2D w/ 2 Axle Trailer	4	6.00-26.00	6.30-40.00	1.00-20.00						12.00-19.99	2.5
7	4 Axle Single Unit	4	6.00-23.09	2.50-6.29	2.50-12.99						12.00 >	3.5
8	Semi, 3S1	4	6.00-26.00	2.50-6.29	13.00-50.00						20.00 >	5.0
8	Semi, 2S2	4	6.00-26.00	8.00-45.00	2.50-20.00						20.00 >	3.5
3	Other w/ 3 Axle Trailer	5	10.11-23.09	6.00-25.00	1.00-11.99	1.00-11.99					1.00-11.99	
5	2D w/ 3 Axle Trailer	5	6.00-23.09	6.30-35.00	1.00-25.00	1.00-11.99					12.00-19.99	2.5
7	5 Axle Single Unit	5	6.00-23.09	2.50-6.29	2.50-6.29	2.50-6.30					12.00 >	3.5
9	Semi, 3S2	5	6.00-30.00	2.50-6.29	6.30-65.00	2.50-11.99					20.00 >	5.0
9	Truck+FullTrailer (3-2)	5	6.00-30.00	2.50-6.29	6.30-50.00	12.00-27.00					20.00>	3.5
9	Semi, 2S3	5	6.00-30.00	16.00-45.00	2.50-6.30	2.50-6.30					20.00 >	3.5
11	Semi+FullTrailer, 2S12	5	6.00-30.00	11.00-26.00	6.00-20.00	11.00-26.00					20.00 >	3.5
10	Semi, 3S3	6	6.00-26.00	2.50-6.30	6.10-50.00	2.50-11.99	2.50-10.99				20.00 >	5.0
12	Semi+Full Trailer, 3S12	6	6.00-26.00	2.50-6.30	11.00-26.00	6.00-24.00	11.00-26.00				20.00 >	5.0
13	7 Axle Multi's	7	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00			20.00 >	5.0
13	8 Axle Multi's	8	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00		20.00 >	5.0
13	9 Axle Multi's	9	6.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	3.00-45.00	20.00 >	5.0

Spacings in feet
Weights in kips (Lbs/1000)
* Suggested Axle 1 minimum weight threshold if allowed by WIM system's class algorithm programming

System Operating Parameters

Kansas SPS-2 (Lane 1)

Validation Visit – 18 April, 2007

Calibration factor for sensor #1:

88 kph:	3784
96 kph:	3901
104 kph:	3943
112 kph:	3980
120 kph:	3922

Calibration factor for sensor #2:

88 kph:	3784
96 kph:	3901
104 kph:	3943
112 kph:	3980
120 kph:	3922